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Side 1 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
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PDF-trykkdato: 31.01.2018
Kjølemiddel R1234yf
8887100019/8887100016

Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II

AVSNITT 1: IDENTIFIKASJON AV STOFFET/STOFFBLANDINGEN OG AV SELSKAPET/FORETAKET

1.1 Produktidentifikator

Kjølemiddel R1234yf 8887100019/8887100016

2,3,3,3-Tetrafluorpropene
Registreringsnummer (ECHA): 01-0000019665-61-XXXX
Index: ---
EINECS, ELINCS, NLP: 468-710-7
CAS: 754-12-1

1.2 Identifiserte relevante bruksområder for stoffet eller stoffblandingen og bruk som det advares mot

Identifisert relevant bruk av stoffet eller blandingen:

Kjølemedium

Bruk som frarådes:

Det foreligger foreløpig ingen informasjon om dette.

1.3 Opplysninger om leverandøren av sikkerhetsdatabladet

Dometic WAECO International GmbH, Hollefeldstr. 63, 48282 Emsdetten, Tyskland
Telefon:+49 (0) 2572 879 0, Telefaks:+49 (0) 2572 879 300

E-postadresse på den sakkyndige personen: info@chemical-check.de, k.schnurbusch@chemical-check.de - må IKKE brukes til å be om sikkerhetsdatablader.

1.4 Nødtelefonnummer

Informasjon i nødstilfelle / offentlig rådgivningsorgan:

N

Giftinformasjonen, Oslo. Døgnåpen telefon 22 59 13 00

Nødtelefonnummer for selskapet:

+49 (0) 700 / 24 112 112 (CCWA)

AVSNITT 2: FAREIDENTIFIKASJON

2.1 Klassifisering av stoffet eller stoffblandingen

Klassifisering i henhold til Forordning (EF) 1272/2008 (CLP)

| Fareklasse | Farekategori | Farehenviing |
|------------|--------------|--|
| Flam. Gas | 1 | H220-Ekstremt brannfarlig gass. |
| Press. Gas | (Liq.) | H280-Inneholder gass under trykk, kan eksplodere ved oppvarming. |

2.2 Merkingselementer

Merking i henhold til Forordning (EF) 1272/2008 (CLP)

Side 2 av 11

Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
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PDF-trykkdato: 31.01.2018
Kjølemiddel R1234yf
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2,3,3,3-Tetrafluorpropene
CAS: 754-12-1, Index:--- EC: 468-710-7

Fare

H220-Ekstremt brannfarlig gass. H280-Inneholder gass under trykk, kan eksplodere ved oppvarming.

P210-Holdes vekk fra varme, varme overflater, gnister, åpen ild og andre antenningskilder. Røyking forbudt. P281-Bruk påkrevd personlig verneutstyr.

P377-Brann ved gasslekkasje: Ikke slukk med mindre lekkasjen kan stanses på en sikker måte. P381-Fjern alle tennkilder ved lekkasje.

P410+P403-Beskyttes mot sollys. Oppbevares på et godt ventilert sted.

2.3 Andre farer

Ikke noe vPvB-stoff

Ikke noe PBT-stoff

Væskesprøyter eller dusjtåke kan forårsake forfrysninger.

Bristefare ved oppvarming

AVSNITT 3: SAMMENSETNING/OPPLYSNINGER OM BESTANDDELER

3.1 Stoff

| | |
|---|--|
| 2,3,3,3-Tetrafluorpropene | |
| Registreringsnummer (REACH) | 01-0000019665-61-XXXX |
| Index | --- |
| EINECS, ELINCS, NLP | 468-710-7 |
| CAS | 754-12-1 |
| % område | |
| Klassifisering i henhold til Forordning (EF) 1272/2008 (CLP) | Flam. Gas 1, H220 Press. Gas (Liq.), H280 |

3.2 Blanding

i.a.

For teksten til H-setningene og klassifiseringsforkortelsene (GHS/CLP), se avsnitt 16.

Stoffene som er nevnt i dette avsnittet, er nevnt med deres faktiske, riktige klassifisering!

Det betyr for stoffer som er angitt i Vedlegg VI i Tabell 3.1 i EU-forordning nr. 1272/2008 (CLP-forordningen), at alle evt. angitte merknader som er nevnt der, er hensyntatt for klassifiseringen.

AVSNITT 4: FØRSTEHJELPSTILTAK

4.1 Beskrivelse av førstehjelpstiltak

Førstehjelper må sørge for egenbeskyttelse!

En bevisstløs person må aldri tilføres væske gjennom munnen!

Side 3 av 11

Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
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Kjølemiddel R1234yf
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Innånding

Fjern personen fra fareområdet.
La personen få frisk luft, oppsøk lege omgående.
Bring i stabilt sideleie ved bevisstløshet og innhent råd fra lege.
Stans i åndingen - kunstig åndedrett med apparat nødvendig.

Hudkontakt

Vask grundig med mye vann, fjern skitne, tilsølte klær øyeblikkelig, ved irritasjon av huden (rødfarging e.l.), kontakt lege.
Forfrysninger avdekkes kimfritt.

Øyekontakt

Fjern kontaktlinser.
Skyll grundig med mye vann i flere minutter (evt. flaske for øyeskylling), tilkall lege omgående. Hold databladet klart.

Inntak gjennom munnen

Vanligvis ingen opptaksvei.

4.2 De viktigste symptomene og virkningene, både akutte og forsinkede

Hvis relevant, er symptomer og virkninger som oppstår forsinket, oppført i avsnitt 11, eller ved opptaksveiene under avsnitt 4.1.
I visse tilfeller kan det forekomme, at forgiftningssymptomene først opptrer etter lengre tid/etter flere timer.

døsighet

Hodepine

støy

Ved høye konsentrasjoner:

Kvelende virkning.

Offeret merker ikke kvelningen.

4.3 Angivelse av om umiddelbar legehjelp og spesialbehandling er nødvendig

Symptomatisk behandling.

Det må ikke gis adrenalin-efedrin preparater.

AVSNITT 5: BRANNSLOKKINGSTILTAK

5.1 Slokkingsmidler

Egnede slokkingsmidler

Vanndustråle/alkoholbest. skum/CO2/tørt slukningsmiddel

Ueguede slokkingsmidler

Kraftig vannstråle

5.2 Særlige farer knyttet til stoffet eller stoffblandingen

I tilfelle av brann kan det dannes:

Fluorvannstoff

Kulloksider

Giftige gasser

Bristefare ved oppvarming

5.3 Råd til brannmannskaper

Unngå innånding av røyken som oppstår ved brann eller eksplosjon.

Luftuavhengig åndedrettsvern.

Full beskyttelse

Avkjøl utsatte beholdere med vann.

Kontaminert vann til slukking skal deponeres i henhold til myndighetenes forskrifter.

AVSNITT 6: TILTAK VED UTILSIKTET UTSLIPP

6.1 Personlige forsiktighetsregler, personlig verneutstyr og nødrutiner

Hold nødvendig personale på avstand.

Fjern antenneskilder. Røyking forbudt.

Sørg for tilstrekkelig ventilasjon.

Unngå øye- og hudkontakt samt innånding.

6.2 Forsiktighetsregler med hensyn til miljø

Unngå både at produktet trenger inn i overflate- eller grunnvannet, og ned i marken.

Unngå inntrengning i kloakkavløp, kjellere, reparasjonsgraver eller andre steder der ansamlingen kunne være farlig.

N

Side 4 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
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8887100019/8887100016

Myndighetene varsles omgående hvis produktet er kommet inn i kloakkanlegget som følge av et uhell.

6.3 Metoder og materialer for oppsamling og rensing

Sørg for tilstrekkelig med frisk luft ved utslipp av aerosol/gass.
La det fordampe.

6.4 Henvisning til andre avsnitt

Personlig sikkerhetsutrustning, se avsnitt 8, henvisninger om disponering, se avsnitt 13.

AVSNITT 7: HÅNDTERING OG LAGRING

I tillegg til opplysningene i dette avsnittet finner du også relevante opplysninger i avsnitt 8 og 6.1.

7.1 Forsiktighetsregler for sikker håndtering

7.1.1 Generelle anbefalinger

Sørg for god romventilasjon.
Romlufting også i gulvhøyde.
Unngå innånding av dampene.
Unngå øye- og hudkontakt.
Holdes unna antennelseskilder. Røyking forbudt.
Ta forholdsregler mot elektrostatisk opplading.
Bruk eksplosjonsbeskyttede apparater.
Må ikke brukes på varme overflater.
Det er forbudt å spise, drikke og røyke, samt å oppbevare næringsmidler i arbeidsrommet.
Obserér henvisningene på etiketten og i bruksanvisningen.
Bruk arbeidsmetoder i henhold til driftsveiledning.

7.1.2 Henvisninger til generelle hygienetiltak på arbeidsplassen

De generelle hygieniske forholdsregler i omgang med kjemikalier må overholdes.
Før pauser og ved arbeidets slutt skal hendene vaskes.
Må ikke oppbevares sammen med næringsmidler, drikkevarer eller dyrefôr.
Legg fra deg kontaminerte klær og sikkerhetsutrustning før du går inn i områder som blir brukt til å spise.

7.2 Vilkår for sikker lagring, herunder eventuelle uforenligheter

Oppbevares utilgjengelig for uvedkommende.
Produktet må kun lagres lukket og i original emballasje.
Produktet må ikke lagres i ganger og trappeoppganger.
Må ikke lagres sammen med brannfremmende eller selvantennelige stoffer.
Må beskyttes mot solpåvirkning og temperaturer over 50°C.
Må lagres kjølig.
Lagres på et godt ventilert sted.
Overhold spesialforskrifter for gasser.

7.3 Særlig(e) sluttanvendelse(r)

Det foreligger foreløpig ingen informasjon om dette.

AVSNITT 8: EKSPONERINGSKONTROLL/PERSONBESKYTTELSE

8.1 Kontrollparametere

8.2 Eksponeringskontroll

8.2.1 Hensiktsmessige tekniske kontroller

Sørg for god utlufting. Dette kan oppnås med avsuging på stedet eller generell utblåsningsluft.
Dersom dette ikke er nok for å holde konsentrasjonen under AN- eller AGW-verdiene (maksimal tillatt konsentrasjon), bruk egnet åndedrettsvern.
Gjelder bare når det er oppført eksponeringsgrenseverdier her.

8.2.2 Individuelle vernetiltak, som f.eks. personlig verneutstyr

De generelle hygieniske forholdsregler i omgang med kjemikalier må overholdes.
Før pauser og ved arbeidets slutt skal hendene vaskes.

Side 5 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
Trer i kraft fra: 07.03.2017
PDF-trykkdato: 31.01.2018
Kjølemiddel R1234yf
8887100019/8887100016

Må ikke oppbevares sammen med næringsmidler, drikkevarer eller dyrefôr.
Legg fra deg kontaminerte klær og sikkerhetsutrustning før du går inn i områder som blir brukt til å spise.

Vern av øyne/ansikt:
Vernebriller, tettsittende med sidevern (EN 166).

Hudvern - Håndvern:
Skinnhansker
Eventuell (-elt)
Isolerende hansker EN 511 (kulde)
De påviste gjennombruddstider ifølge EN 374 del 3 ble ikke gjennomført under praksisbetingelsene.
Det anbefales en maksimal bæretid som tilsvarer 50% av gjennombruddstiden.

Hudvern - Andre:
Arbeidsverneklær (f.eks. vernesko EN ISO 20345, verneantrekk, langarmet).

Åndedrettsvern:
Ta på åndedrettsvern ved utilstrekkelig ventilasjon.
Luftuavhengig åndedrettsvern.
Følg tidsbegrensninger når det gjelder bruk av åndedrettsvern.

Varmefarer:
Der hvor det passer, er disse ført opp ved de enkelte sikkerhetstiltakene (øye-/ansiktsbeskyttelse, hudbeskyttelse, åndedrettsvern).

Tilleggsinformasjon til vernehansker - Det er ikke gjennomført noen tester.
Ved blandinger er valget foretatt med utgangspunkt i førstehåndskunnskap og på bakgrunn av informasjon om innholdsstoffene.
Utvalget ble hentet for stoffer ut fra angivelser fra fabrikanten for hanskene.
Det endelige valg av hanskemateriale må skje idet man tar hensyn til gjennombruddstidene, permeationsratene og degraderingen.
Valget av en egnet hanske er ikke bare avhengig av materialet, men også av øvrige kvalitetskjennetegn som varierer fra produsent til produsent.
Ved blandinger er stabiliteten til hanskematerialer ikke forutsigbar og må derfor kontrolleres før bruk.
Den nøyaktige gjennombruddstid for hanskematerialet må produsenten av vernehansker erfare og tilpasse.

8.2.3 Begrensning og overvåkning av miljøeksponeringen

Det foreligger foreløpig ingen informasjon om dette.

AVSNITT 9: FYSISKE OG KJEMISKE EGENSKAPER

9.1 Opplysninger om grunnleggende fysiske og kjemiske egenskaper

| | |
|-----------------------------------|---|
| Fysisk tilstand: | Kondensert gass |
| Farge: | Fargeløs |
| Lukt: | Svak |
| Luktterskel: | Ikke bestemt |
| pH-verdi: | i.a. |
| Smeltepunkt/smelteområde: | Ikke bestemt |
| Kokepunkt/kokeområde: | -29,4 °C |
| Flammepunkt: | i.a. |
| Fordampningshastighet: | Ikke bestemt |
| Antennelighet (fast stoff, gass): | Ekstremt brannfarlig |
| Nedre eksplosjonsgrense: | 6,2 Vol-% |
| Øvre eksplosjonsgrense: | 12,3 Vol-% |
| Damptrykk: | 6067 hPa (21°C) |
| Damptrykk: | 14203 hPa (54°C) |
| Damptetthet (luft = 1): | 4 |
| Tetthet: | 1,1 g/cm ³ (25°C) |
| Pakningstetthet: | Ikke bestemt |
| Løselighet: | Ikke bestemt |
| Vannløselighet: | 198,2 mg/l (24°C, Regulation (EC) 440/2008 A.6. (WATER SOLUBILITY)) |

N

Side 6 av 11
 Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
 Revidert den / Versjon: 07.03.2017 / 0004
 Erstatte utgave fra / Versjon: 27.07.2016 / 0003
 Trer i kraft fra: 07.03.2017
 PDF-trykkdato: 31.01.2018
 Kjølemiddel R1234yf
 8887100019/8887100016

| | |
|---|---|
| Fordelingskoeffisient (n-oktanol/vann): | 2,15 (Regulation (EC) 440/2008 A.8. (PARTITION COEFFICIENT)) |
| Selvantennelighet: | 405 °C |
| Nedbrytningstemperatur: | Ikke bestemt |
| Viskositet: | Ikke bestemt |
| Ekspløsjonsegenskaper: | Produktet er ikke eksplosjonsfarlig. Bruk: Dannelse av eksplosjonsfarlige damp-/luftblandinger mulig. |
| Oksidasjonsegenskaper: | Ikke bestemt |
| 9.2 Andre opplysninger | |
| Blandbarhet: | Ikke bestemt |
| Fettløselighet / løsemiddel: | Ikke bestemt |
| Konduktivitet: | Ikke bestemt |
| Overflatespenning: | Ikke bestemt |
| Løsemiddelinnhold: | Ikke bestemt |
| Molar masse: | 114 g/mol |

AVSNITT 10: STABILITET OG REAKTIVITET

10.1 Reaktivitet

Produktet ble ikke testet.

10.2 Kjemisk stabilitet

Stabil ved faglig korrekt lagring og håndtering.

10.3 Mulighet for farlige reaksjoner

Ingen farlige reaksjoner er kjent.

10.4 Forhold som skal unngås

Se også avsnitt 7.

Oppvarming, åpne flammer, antennelseskilder

10.5 Uforenlige materialer

Se også avsnitt 7.

Alkalimetaller

Magnesium

Sink

Lettmetaller

10.6 Farlige nedbrytingsprodukter

Se også avsnitt 5.2.

Ingen spaltning ved riktig bruk.

AVSNITT 11: TOKSIKOLOGISKE OPPLYSNINGER

11.1 Opplysninger om toksikologiske virkninger

For eventuell ytterligere informasjon om virkninger på helsen, se avsnitt 2.1 (klassifisering).

| Giftighet / virkning | Endepunkt | Verdi | Enhet | Organisme | Testmetode | Merknad |
|---|-----------|-------|-------|-----------|------------|---------|
| Akutt giftighet, oral: | t | | | | | i.d.f. |
| Akutt giftighet, dermal: | | | | | | i.d.f. |
| Akutt giftighet, innånding: | | | | | | i.d.f. |
| Hudetsing/hudirritasjon: | | | | | | i.d.f. |
| Alvorlig øyeskade/øyeirritasjon: | | | | | | i.d.f. |
| Sensibilisering ved innånding/av huden: | | | | | | i.d.f. |
| Skader på arvestoffet i kjønnseller: | | | | | | i.d.f. |
| Kreftframkallende egenskap: | | | | | | i.d.f. |
| Reproduksjonstoksitet: | | | | | | i.d.f. |

N

Side 7 av 11
 Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
 Revidert den / Versjon: 07.03.2017 / 0004
 Erstatte utgave fra / Versjon: 27.07.2016 / 0003
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 Kjølemiddel R1234yf
 8887100019/8887100016

| | | | | | | | |
|--|--|--|--|--|--|--|--------|
| Giftvirkning på bestemte organer - enkelteksponering (STOT-SE): | | | | | | | i.d.f. |
| Giftvirkning på bestemte organer - gjentatt eksponering (STOT-RE): | | | | | | | i.d.f. |
| Aspirasjonsfare: | | | | | | | i.d.f. |
| Symptomer: | | | | | | | i.d.f. |

AVSNITT 12: ØKOLOGISKE OPPLYSNINGER

For eventuell ytterligere informasjon om virkninger på miljøet, se avsnitt 2.1 (klassifisering).

| Giftighet / virkning | Endepunkt | Tid | Verdi | Enhet | Organisme | Testmetode | Merknad |
|---|-----------|-----|-------|-------|-----------|------------|---------|
| 12.1. Giftighet for fisk: | | | | | | | i.d.f. |
| 12.1. Giftighet for Daphnia: | | | | | | | i.d.f. |
| 12.1. Giftighet for alger: | | | | | | | i.d.f. |
| 12.2. Persistens og nedbrytbarhet: | | | | | | | i.d.f. |
| 12.3. Bioakkumuleringsevne: | | | | | | | i.d.f. |
| 12.4. Mobilitet i jord: | | | | | | | i.d.f. |
| 12.5. Resultater av PBT- og vPvB-vurdering: | | | | | | | i.d.f. |
| 12.6. Andre skadevirkninger: | | | | | | | i.d.f. |

AVSNITT 13: DISPONERING

13.1 Avfallsbehandlingsmetoder

For stoffet / blandingen / restmengden

Avfallsnøkkel-nr. EF:

De nevnte avfallsnøkklene er anbefalinger grunnlagt på forutsigbar bruk av dette produktet.

På grunn av denne spesielle bruken og muligheter for behandling av avfallsproduktet for bruker kan det under visse omstendigheter tilpasses andre avfallsnøkler. (2014/955/EU)

14 06 01 klorfluorkarboner, HKFK, HFK

14 06 01 klorfluorkarboner, HKFK, HFK

Anbefaling:

13.1 Avfallsbehandlingsmetoder

Overhold lokale forskrifter fra myndighetene.

For eksempel egnet forbrenningsanlegg.

For forurenset emballasjemateriale

Overhold lokale forskrifter fra myndighetene.

Anbefaling:

Returneres produsenten med resterende trykk.

15 01 04 emballasje av metall

AVSNITT 14: TRANSPORTOPPLYSNINGER

Generelle opplysninger

14.1. FN-nummer:

3161

Vei- / jernbanetransport (ADR/RID)

14.2. FN-forsendelsesnavn:



N

Side 8 av 11
 Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
 Revidert den / Versjon: 07.03.2017 / 0004
 Erstatte utgave fra / Versjon: 27.07.2016 / 0003
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 8887100019/8887100016

UN 3161 LIQUEFIED GAS, FLAMMABLE, N.O.S. (R-1234YF)

14.3. Transportfareklasse(r): 2.1
 14.4. Emballasjegruppe: -
 Klassifiseringskode: 2F
 LQ: 0
 14.5. Miljøfarer: Ikke relevant
 Tunnel restriction code: B/D

Sjøtransport (IMDG-kode)

14.2. FN-forsendelsesnavn:
 LIQUEFIED GAS, FLAMMABLE, N.O.S. (R-1234YF)
 14.3. Transportfareklasse(r): 2.1
 14.4. Emballasjegruppe: -
 EmS: F-D, S-U
 Havforurensende stoff (Marine Pollutant): i.a.
 14.5. Miljøfarer: Ikke relevant



Transport med fly (IATA)

14.2. FN-forsendelsesnavn:
 Liquefied gas, flammable, n.o.s. (R-1234YF)
 14.3. Transportfareklasse(r): 2.1
 14.4. Emballasjegruppe: -
 14.5. Miljøfarer: Ikke relevant



14.6. Særlige forsiktighetsregler ved bruk

Personer som arbeider med transport av farlig gods må ha fått nødvendig opplæring.
 Forskriftene for sikring må overholdes av alle personer som deltar i transporten.
 Det må tas forholdsregler for å unngå skader.

14.7. Bulktransport i henhold til vedlegg II i MARPOL og IBC-regelverket

Frakten transporteres ikke som masse gods, men som stykk gods, derfor er det ikke relevant.
 Det tas her ikke hensyn til regler for mindre mengder.
 Farekode samt emballasje-koding på forespørsel.
 Følg særskilte bestemmelser (special provisions).

AVSNITT 15: OPPLYSNINGER OM BESTEMMELSER

15.1 Særlige bestemmelser/særskilt lovgivning om sikkerhet, helse og miljø for stoffet eller stoffblandingen

Innskrenkninger må overholdes:
 Vær oppmerksom på arbeidsmedisinske forskrifter og forskrifter fra yrkesforeninger.

Direktiv 2012/18/EU ("Seveso-III"), vedlegg I, del 1 - Følgende kategorier er relevante for dette produktet (eventuelt må det tas hensyn til flere, avhengig av lagring, håndtering osv.):

| Farekategorier | Merknader i vedlegg I | Mengdegrense (i tonn) for farlige stoffer i henhold til artikkel 3 nr. 10 for bruk av - Krav til bedrifter av den lavere klasse | Mengdegrense (i tonn) for farlige stoffer i henhold til artikkel 3 nr. 10 for bruk av - Krav til bedrifter av den høyere klasse |
|----------------|-----------------------|---|---|
| P2 | | 10 | 50 |

For tilordningen av kategoriene og mengdegrensene må merknadene i vedlegg I i direktiv 2012/18/EU alltid følges, i særdeleshet merknadene i tabellene som er nevnt her og merknadene 1 - 6.

DIREKTIV 2010/75/EU (VOC): 100 %

15.2 Vurdering av kjemikaliesikkerhet

En kjemisk sikkerhetsvurdering ble gjennomført.

AVSNITT 16: ANDRE OPPLYSNINGER

N

Side 9 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
Trer i kraft fra: 07.03.2017
PDF-trykkdato: 31.01.2018
Kjølemiddel R1234yf
8887100019/8887100016

Endrede avsnitt: 2,16
Opplæring av medarbeiderne i håndtering av farlig gods er nødvendig.
Disse opplysningene refererer til produktet i leveringstilstand.
Innføring/opplæring av medarbeiderne i håndtering av farlige stoffer er nødvendig.
Etterfølgende setninger representerer de komplette H-setningene, koden for fareklasse og farekategori (GHS/CLP) for produktet og innholdsstoffene (nevnt i avsnitt 2 og 3).
H280 Inneholder gass under trykk, kan eksplodere ved oppvarming.
H220 Ekstremt brannfarlig gass.

Flam. Gas — Flammable gases (including chemically unstable gases)
Press. Gas (Liq.) — Gases under pressure-Liquefied gas

Forkortelser og akronymer som eventuelt er brukt i dette dokumentet:

AC Article Categories
ACGIH American Conference of Governmental Industrial Hygienists
ADR Accord européen relatif au transport international des marchandises Dangereuses par Route
alkoholbest. alkoholbestandig
AN, KV, TV AN = Administrative normer for forurensning i arbeidsatmosfære, KV = Korttidsverdi, TV = Takverdi (At-Veiledning, nr. 361)
Anm. Anmerking
AOEL Acceptable Operator Exposure Level
AOX Adsorberbare organiske halogenforbindelser
ATE "Acute Toxicity Estimate" i henhold til Forordning (EF) 1272/2008 (CLP)"
BAM Bundesanstalt für Materialforschung und -prüfung (statlig organ for materialforskning og -kontroll, Tyskland)
BAuA Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (= statsanstalt for arbeidsvern og arbeidsmedisin, Tyskland)
BCF Bioconcentration factor (= biokonsentrasjonsfaktor)
bem. bemerkning
BGV Biologisk grenseverdi
BHT Butylhydroxytoluol (= 2,6-Di-t-butyl-4-metyl-fenol)
BOD Biochemical oxygen demand (= Biokjemisk oksygenforbruk)
BSEF Bromine Science and Environmental Forum
bw body weight (= kroppsvekt)
ca. cirka
CAS Chemical Abstracts Service
CEC Coordinating European Council for the Development of Performance Tests for Fuels, Lubricants and Other Fluids
CESIO Comité Européen des Agents de Surface et de leurs Intermédiaires Organiques
CIPAC Collaborative International Pesticides Analytical Council
CLP Classification, Labelling and Packaging (FORORDNING (EF) nr. 1272/2008 om klassifisering, merking og emballering av stoffer og blandinger)
CMR carcinogenic, mutagenic, reproductive toxic (karsinogen, mutagen, reproduktiv gift)
COD Chemical oxygen demand (= Kjemisk oksygenforbruk)
CTFA Cosmetic, Toiletry, and Fragrance Association
DMEL Derived Minimum Effect Level
DNEL Derived No Effect Level
DOC Dissolved organic carbon (= Oppløst organisk kullstoff)
DT50 Dwell Time - 50% reduction of start concentration
dw dry weight (= tørrvekt)
e.l., osv. eller lignende, og så videre
ECHA European Chemicals Agency
EF Europeiske Fellesskap
EINECS European Inventory of Existing Commercial Chemical Substances
ELINCS European List of Notified Chemical Substances
EPA United States Environmental Protection Agency (United States of America)
ERC Environmental Release Categories
EU Europeiske Union
EØF Europeiske Økonomiske Fellesskap
EØS Europeiske Økonomiske Samarbeidsområdet
f.eks. for eksempel

N

Side 10 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
Trer i kraft fra: 07.03.2017
PDF-trykkdato: 31.01.2018
Kjølemiddel R1234yf
8887100019/8887100016

Faks. Faksnummer
GHS Globally Harmonized System of Classification and Labelling of Chemicals (= Globalt Harmoniserte System for klassifisering og merking av kjemikalier)
GWP Global warming potential (= Drivhuspotensial)
HET-CAM Hen's Egg Test - Chorionallantoic Membrane
HGWP Halocarbon Global Warming Potential
hhv. henholdsvis
i.a. ikke anvendelig
i.d. ikke disponibel
i.d.f. ingen data foreligger
i.k. ikke kontrollert
IARC International Agency for Research on Cancer
IATA International Air Transport Association
IBC Intermediate Bulk Container
IBC (Code) International Bulk Chemical (Code)
iht., iflg. i henhold til, ifølge
IMDG-kode International Maritime Code for Dangerous Goods (IMDG-code)
inkl. inklusive
IUCLID International Uniform Chemical Information Database
Kons. Konsentrasjon
LQ Limited Quantities
Min., min. Minut(er) eller minsta eller minimum
NIOSH National Institute of Occupational Safety and Health (United States of America)
ODP Ozone Depletion Potential (= Osonnedbrytingspotensial)
OECD Organisation for Economic Co-operation and Development
org. organisk
PAK polysykliske aromatiske kullvannstoffer
PBT persistent, bioaccumulative and toxic (= persistente, bioakkumulerende, toksiske)
PC Chemical product category
PE Polyetylen
PNEC Predicted No Effect Concentration
PROC Process category
PTFE Polytetrafluoretylen
REACH Registration, Evaluation, Authorisation and Restriction of Chemicals (Forordning (EF) nr. 1907/2006 om registrering, evaluering, autorisasjon og restriksjoner av kjemikalier)
REACH-IT List-No. 9xx-xxx-x No. is automatically assigned, e.g. to pre-registrations without a CAS No. or other numerical identifier. List Numbers do not have any legal significance, rather they are purely technical identifiers for processing a submission via REACH-IT.
resp. respektive
RID Règlement concernant le transport International ferroviaire de marchandises Dangereuses
SADT Self-Accelerating Decomposition Temperature (= selvakselererende nedbrytningstemperatur)
SU Sector of use
SVHC Substances of Very High Concern
ThOD Theoretical oxygen demand (= Teoretisk oksygenforbruk)
TOC Total organic carbon (= Totalt organisk kullstoff)
UN RTDG United Nations Recommendations on the Transport of Dangerous Goods
VbF Verordnung über brennbare Flüssigkeiten (= Forordning om brennbare væsker (Østerrike))
VOC Volatile organic compounds (= flyktige organiske forbindelser (FOF))
vPvB very persistent and very bioaccumulative
WHO World Health Organization (= Verdens helseorganisasjon)
wwt wet weight

Disse opplysningene skal beskrive produktet med hensyn til nødvendige sikkerhetstiltak. De tjener ikke til å tilsikre bestemte egenskaper. De tjener ikke til å tilsikre bestemte egenskaper og er basert på vår viten pr. dags dato.

Vi overtar intet ansvar.

Utstedt av:

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N

Side 11 av 11
Sikkerhetsdatablad iht. forordning (EF) nr. 1907/2006, vedlegg II
Revidert den / Versjon: 07.03.2017 / 0004
Erstatter utgave fra / Versjon: 27.07.2016 / 0003
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Kjølemiddel R1234yf
8887100019/8887100016

krever uttrykkelig godkjenning av Chemical Check GmbH Gefahrstoffberatung.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

Annex of Safety data sheet

| Identified use: ES and title | Sector of Use (SU) | Product Category (PC) Article Category (AC) | Process category (PROC) | Environmental Release Category (ERC) |
|--|-----------------------|--|---------------------------------------|--|
| ES 1 : Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants | SU 3, 10, 17 | PC 16 AC 1, 2 | PROC 8b, 9 | ERC 7 |
| ES 2 : Professional Use, Heat Transfer Fluids – Refrigerants, Coolants | SU 22 | PC 16 AC 1, 2 | PROC 8a | ERC 9b |
| ES 3 : Formulation of preparations | SU 3, 10, 17 | PC 16 AC 1, 2 | PROC 3 | ERC 2 |
| ES 4 : Use, service life, and waste stage environmental exposure | SU 3, 10, 17, 21, 22 | Only environmental releases evaluated | Only environmental releases evaluated | ERC 2, 7, 9a, and 9b |

Overview of Uses and Exposure Scenarios

HFO-1234yf is used as a heat transfer fluid in mobile air conditioning (MAC) equipment and in stationary air conditioning and refrigeration equipment. It is imported into the European Union (EU) and used by workers at Original Equipment Manufacturers (OEMs) to charge MAC and stationary equipment. Workers also use HFO-1234yf when servicing charged equipment during its service life or when dismantling charged equipment at the end of its service life. In addition, workers use the substance during blending and repackaging activities. Worker exposure may potentially occur during the activities associated with these uses, but exclusively when disconnecting and/or connecting the tight seal shut-off valve coupler hoses during transfer operations. Therefore, the exposure potential is limited in time and minimized in amount due to the coupler system employed. Environmental exposure is also a possibility when conducting these transfer operations. Minimal releases to the ambient air may potentially occur during activities such as blending and repackaging of the substance, charging and servicing of equipment, dismantling of equipment, and if leakages occur from the charged equipment during its service life. Releases to other environmental compartments beside the ambient air are not possible because HFO-1234yf is a liquefied gas.

Potential consumer exposure is limited to those extremely rare occasions when all of the following conditions are met: the MAC is leaking, HFO-1234yf vents directly into the passenger compartment of the automobile, the passenger compartment remains totally closed, and passengers are present in the car.

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

1.1 Exposure Scenario ES1

Industrial Use, Heat Transfer Fluids – Refrigerants, Coolants

Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) : General manufacturing, e.g., machinery, equipment, vehicles, other transport equipment (SU17) excluding buses

Contributing environmental scenario CS1: Industrial use of substances in closed systems (ERC7). Quantified in ES4

Contributing worker scenario CS2: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) (PROC9)

Contributing worker scenario CS3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC8b)

Exposure Scenario 1 (ES 1) describes the activities and processes covered when workers charge various types of packaging, A/C and refrigeration equipment in an industrial setting. It includes:

- Refrigerant packaging workers,
- Automobile original equipment manufacturer (OEM) assembly workers, and
- Stationary equipment OEM assembly workers.

1.2.1 Contributing scenario CS1 controlling environmental exposure for ERC 7

Industrial use of substances in closed systems

Assessed and quantified in ES4

Product characteristics

Low global warming potential (GWP) liquefied gas with a concentration of 100%; Not biodegradable

Amounts used

9000 tonnes per annum (tpa) – EU

Frequency and duration of use

Continuous use/8-hour shift, 200 operating days/year; Intermittent release

Environmental factors not influenced by risk management

None

Other given operational conditions affecting environmental exposure

Under normal conditions of use, exposure would primarily occur when workers disconnect the couplings. Conservatively assumed that approximately 1% (5 grams/mobile A/C) released to air (Henne et al., 2012; Reimann & Shallcross et al., 2011) (release fraction of 0.01).

Technical conditions and measures at process level (source) to prevent release

Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

None

Organizational measures to prevent/limit release from site

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

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|---|
| Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines. |
| Conditions and measures related to municipal sewage treatment plant |
| No STP |
| Conditions and measures related to external treatment of waste for disposal |
| Not applicable |
| Conditions and measures related to external recovery of waste |
| Not applicable |
| 1.2.2 Contributing scenario CS2 controlling worker exposure for PROC 9 |
| Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Product characteristic |
| Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature. |
| Amounts used |
| 120 kg/8-hour shift – worker; ~50 000 kg/y for plant site producing 100 000 vehicles per year |
| Frequency and duration of use/exposure |
| Duration of use/exposure: Intermittent; 20 min/8-hour shift (Under normal operation exposure occurs only at ending of filling process (disconnection), estimated at 0.083 min (5 sec) per disconnecting process x1 processes/fill x 30 fills/hr x 8 hr/shift) Frequency: 200 days/year |
| Human factors not influenced by risk management |
| Light work, respiration volume = 10 m ³ /8-hour shift |
| Other given operational conditions affecting workers exposure |
| Indoor use; Under normal conditions of use, exposure would primarily occur when workers disconnect the couplings. |
| Technical conditions and measures at process level (source) to prevent release |
| Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling. |
| Technical conditions and measures to control dispersion from source towards the worker |
| Mechanical ventilation giving at least [ACH]: 3; Room volume: >50 m ³ .; Local exhaust ventilation (Effectiveness: < 10 ppm) |
| Organizational measures to prevent/limit releases, dispersion and exposure |
| Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise |

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

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| exposures. |
| Conditions and measures related to personal protection, hygiene and health evaluation |
| Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. |
| 1.2.3 Contributing scenario CS3 controlling worker exposure for PROC 8b. |
| Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities |
| Product characteristic |
| Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature. |
| Amounts used |
| Not applicable |
| Frequency and duration of use/exposure |
| Duration of use/exposure: Intermittent; Conservatively assumed less than 15 minutes/day Frequency: 200 days/year |
| Human factors not influenced by risk management |
| Light work, respiration volume = 10 m ³ /8-hour shift |
| Other given operational conditions affecting workers exposure |
| Outdoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. |
| Technical conditions and measures at process level (source) to prevent release |
| Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling. |
| Technical conditions and measures to control dispersion from source towards the worker |
| None |
| Organizational measures to prevent/limit releases, dispersion and exposure |
| Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures. |
| Conditions and measures related to personal protection, hygiene and health evaluation |
| Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. |
| 1.3. Exposure estimation and reference to its source |
| ASSESSMENT METHOD: CS1: ECETOC TRA v.3. ; CS2 and CS3: Available measured data for HFC-134a were used to evaluate the worker exposure to HFO-1234yf. For comparison purposes only, ECETOC TRA v.3 was also used to estimate inhalation exposure for workers. |

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

Information for CS1: Local releases to the environment

| Release | Release factor estimation method | Explanation / Justification |
|---------|---|---|
| Water | Process and substance knowledge | Initial release factor: ERC7 assumes 5% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |
| Air | Henne et al., 2012; Reimann & Shallcross et al., 2011 | Initial release factor: ERC7 assumes 5% Final release factor: ~1% Local release rate: ~350 kg/day across entire 27 EU countries plus Croatia, Norway, Switzerland, and Turkey (EU-27+) after 90% of fleet is converted and at a steady state. Explanation / Justification: 5 grams/charging event, which is approximately 1% of the total charge volume (500+ or – grams); Henne et al, 2012; Reimann & Shallcross et al., 2011. |
| Soil | Process and substance knowledge | Initial release factor: ERC7 assumes 5% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are reported in ES4.

Information for CS2: Exposure concentrations and risks for worker

| Route of exposure and type of effects | Exposure concentration | Source for exposure concentration | Exposure concentration and DNEL (or DMEL) units | DNEL (or DMEL) | Risk characterisation |
|---------------------------------------|------------------------|---|---|----------------|-----------------------|
| Inhalation, systemic, long-term | 37 | Bureau Veritas North America, 2008; data generated on HFC-134a | mg/m ³ | 950 | 0.039 |
| | 190 | TRA v.3 tool used to estimate exposure concentration for comparison purposes only | | | 0.2 |
| Inhalation, systemic, acute | Not needed | Not needed | | | Not needed |
| Inhalation, local, long-term | Not needed | Not needed | | | Not needed |
| Inhalation, local, acute | Not needed | Not needed | | | Not needed |

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

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|--------------------------------------|------------|------------|--|--|------------|
| Dermal, systemic, long-term | Not needed | Not needed | | | Not needed |
| Dermal, systemic, acute | Not needed | Not needed | | | Not needed |
| Dermal, local, long-term | Not needed | Not needed | | | Not needed |
| Dermal, local, acute | Not needed | Not needed | | | Not needed |
| Combined routes, systemic, long-term | | | | | 0.039 |
| Combined routes, systemic, acute | | | | | Not needed |

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

Information for CS3: Exposure concentrations and risks for worker

| Route of exposure and type of effects | Exposure concentration | Source for exposure concentration | Exposure concentration and DNEL (or DMEL) units | DNEL (or DMEL) | Risk characterisation |
|---------------------------------------|------------------------|---|---|----------------|-----------------------|
| Inhalation, systemic, long-term | 37 | Bureau Veritas North America, 2008; data generated on HFC-134a | mg/m ³ | 950 | 0.039 |
| | 50 | TRA v.3 tool used to estimate exposure concentration for comparison purposes only | | | 0.05 |
| Inhalation, systemic, acute | Not needed | Not needed | | | Not needed |
| Inhalation, local, long-term | Not needed | Not needed | | | Not needed |
| Inhalation, local, acute | Not needed | Not needed | | | Not needed |
| Dermal, systemic, long-term | Not needed | Not needed | | | Not needed |
| Dermal, systemic, acute | Not needed | Not needed | | | Not needed |
| Dermal, local, long-term | Not needed | Not needed | | | Not needed |
| Dermal, local, acute | Not needed | Not needed | | | Not needed |

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

| | | | | | |
|--------------------------------------|--|--|--|--|------------|
| Combined routes, systemic, long-term | | | | | 0.039 |
| Combined routes, systemic, acute | | | | | Not needed |

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

2.1. Exposure Scenario ES2

Professional Use, Heat Transfer Fluids – Refrigerants, Coolants

Professional uses: Public domain (administration, education, entertainment, services, craftsmen) (SU22)

Contributing environmental scenario CS1: Wide dispersive outdoor use of substances in closed systems (ERC9b). Quantified in ES4.

Contributing worker scenario CS2: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities (PROC8a)

Exposure Scenario 2 (ES 2) describes the activities and processes covered when professional workers service mobile or stationary A/C or refrigeration equipment. Although each of these workers may use different charge quantities of HFO-1234yf at different frequencies and in different professional settings, they all use equipment during the servicing procedure that is similar to the equipment used during industrial refrigerant charging or packaging. Therefore, professional workers have a similar potential for exposure as do industrial workers, except professional users process fewer units during the work shift and they are more likely to perform the work outdoors. If working indoors, however, their work space would likely be smaller than for industrial users. Therefore, a separate exposure scenario was deemed warranted. In general, the potential release to the environment is also the same between the various servicing workers (mobile and stationary) and industrial workers, de minimus release to only air as described in detail in ES1.

2.2.1 Contributing scenario CS1 controlling environmental exposure for ERC9b

Wide dispersive outdoor use of substances in closed systems

Assessed and quantified in ES4

Product characteristics

Low global warming potential (GWP) liquefied gas with a concentration of 100%; Not biodegradable

Amounts used

4000 tonnes per annum (tpa) – EU

Frequency and duration of use

Continuous use/release, 365 operating days/year; Intermittent release

Environmental factors not influenced by risk management

None

Other given operational conditions affecting environmental exposure

Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. Conservatively assumed that approximately 6.4% of charge would be released if servicing completed by a skilled worker and that approximately 64% of charge would be

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

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| released if servicing completed by an unskilled worker (Henne et al, 2012) despite the fact that servicing is only allowed at professional service centers and completed by skilled workers. |
| Technical conditions and measures at process level (source) to prevent release |
| Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling. |
| Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil |
| None |
| Organizational measures to prevent/limit release from site |
| None |
| Conditions and measures related to municipal sewage treatment plant |
| No STP |
| Conditions and measures related to external treatment of waste for disposal |
| Not applicable |
| Conditions and measures related to external recovery of waste |
| Not applicable |
| 2.2.2 Contributing scenario CS2 controlling worker exposure for PROC 8a |
| Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities |
| Product characteristic |
| Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at room temperature. |
| Amounts used |
| Mobile A/C: 0.5 kg/service event; Stationary Equipment: 0.05 – 300 kg/service event |
| Frequency and duration of use/exposure |
| Duration of use/exposure: Intermittent; Mobile A/C: ~1 minute/ 8-hour shift (0.083 minutes (5 seconds) per connecting process x 2 connecting processes per vacuuming/re-charging procedure x 1 servicing event per hour x 8 hours per shift) Stationary Equipment: ~< 1 minute/8-hour shift (0.083 minutes (5 seconds) per connecting process x2 connecting processes per vacuuming/ re-charging procedure x up to 4 servicing events per 8-hour shift) Frequency: 200 days/year |
| Human factors not influenced by risk management |
| Light work, respiration volume = 10 m ³ /8-hour shift |
| Other given operational conditions affecting workers exposure |
| Indoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. |
| Technical conditions and measures at process level (source) to prevent release |
| Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a |

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

None

Organizational measures to prevent/limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

Conditions and measures related to personal protection, hygiene and health evaluation

Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines.

2.3. Exposure estimation and reference to its source

ASSESSMENT METHOD: CS1: TRA v.3. **CS2:** Available measured data on HFC-134a were used to evaluate the professional worker exposure to HFO-1234yf. For comparison purposes only, TRA v.3 was also used to estimate inhalation exposure for workers.

Information for CS1: Local releases to the environment

| Release | Release factor estimation method | Explanation / Justification |
|---------|----------------------------------|---|
| Water | Activity and substance knowledge | Initial release factor: ERC9b assumes 5% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |
| Air | Henne et al., 2012 | Initial release factor: ERC9b assumes 5% Final release factor: ~6.4% of initial charge if servicing by skilled workers; ~64% of initial charge if servicing by unskilled workers Local release rate: 4 580 kg/day across entire EU-27+. Explanation / Justification: Release estimates made by Henne et al., 2012 under the assumption that 90% of entire EU-27+ fleet is converted and at a steady state. |
| Soil | Activity and substance knowledge | Initial release factor: ERC9b assumes 5% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are reported in ES4.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

Information for CS2: Exposure concentrations and risks for worker

| Route of exposure and type of effects | Exposure concentration | Source for exposure concentration | Exposure concentration and DNEL (or DMEL) units | DNEL (or DMEL) | Risk characterisation |
|---------------------------------------|------------------------|--|---|----------------|-----------------------|
| Inhalation, systemic, long-term | 85.6 | Gjølstad et al., 2003; refrigeration repair workers' data generated on HFC-134a | mg/m ³ | 950 | 0.09 |
| | 5.1 | Bureau Veritas North America, 2007; mobile A/C workers; data generated on HFC-134a | | | 0.005 |
| | 240 | TRA v.3 tool used to estimate exposure concentration for comparison purposes only | | | 0.25 |
| Inhalation, systemic, acute | Not needed | Not needed | | | Not needed |
| Inhalation, local, long-term | Not needed | Not needed | | | Not needed |
| Inhalation, local, acute | Not needed | Not needed | | | Not needed |
| Dermal, systemic, long-term | Not needed | Not needed | | | Not needed |
| Dermal, systemic, acute | Not needed | Not needed | | | Not needed |
| Dermal, local, long-term | Not needed | Not needed | | | Not needed |
| Dermal, local, acute | Not needed | Not needed | | | Not needed |
| Combined routes, systemic, long-term | | | | | 0.09 |
| Combined routes, systemic, acute | | | | | Not needed |

The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected.

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

3.1. Exposure Scenario ES3

Formulation of preparations

Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) : General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment (SU17) excluding buses

Contributing environmental scenario CS1: Formulation of preparations (ERC2) (Covered by ES4)

Contributing worker scenario CS2: Use in closed batch process (synthesis or formulation) (PROC3)

Exposure Scenario 3 (ES 3) describes the activities and processes covered when workers blend various types of refrigeration substances and load the products into ISO containers or tanks. The blended products may contain up to nearly 100% of HFO-1234yf. Activities are expected to occur outdoors, but with the same equipment used during the charging and/or packaging procedures described in ES 1. In this process, however, yield rates are set at 99.75%. Therefore, potential releases to ambient air are expected to be < 0.25% and releases to wastewater and soil are expected to be at 0%.

The equipment used for refrigerant blending and loading employs shut-off valve couplers that do not permit release of refrigerant unless a tight seal is made between the blending/filling equipment and the unit. In addition, blending/filling hoses are designed to be connected with the system prior to opening the valve(s) of the containers holding the substances. After blending operations are finished or the containers are filled, the valve(s) are closed prior to decoupling the hoses.

3.2.1 Contributing scenario CS1 controlling environmental exposure for ERC2

Formulation of preparations

Assessed and quantified in ES4

Product characteristics

Low global warming potential (GWP) liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Not biodegradable

Amounts used

5000 tonnes per annum (tpa) – EU; Daily amount: 25 000 kg/day – EU

Frequency and duration of use

Continuous use/8-hour shift, 200 operating days/year; Intermittent release

Environmental factors not influenced by risk management

None

Other given operational conditions affecting environmental exposure

Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. Assumed 0.25% released to air (12.5 tpa), 0% released to wastewater and 0% released to soil.

Technical conditions and measures at process level (source) to prevent release

Process designed to minimize releases to wastewater; Process designed to minimize releases to soil; Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

None

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

| |
|--|
| Organizational measures to prevent/limit release from site |
| Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Regular inspection and maintenance of equipment and machines. |
| Conditions and measures related to municipal sewage treatment plant |
| No STP |
| Conditions and measures related to external treatment of waste for disposal |
| Not applicable |
| Conditions and measures related to external recovery of waste |
| Not applicable |
| 3.2.2 Contributing scenario CS2 controlling worker exposure for PROC 3 |
| Use in closed batch process (synthesis or formulation) |
| Product characteristic |
| Liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at ambient temperature (unless stated differently). |
| Amounts used |
| Up to 2 500 kg/shift – worker, based on conservative yearly volume estimate and two shifts/day with five workers/shift |
| Frequency and duration of use/exposure |
| Intermittent; 8-hour shift; 200 days/year; Conservatively assumed less than 15 minutes exposure duration/worker, which is based on 70 to 100 connections per day with two shifts/day, five workers/shift, and 30 seconds potential exposure/connection. |
| Human factors not influenced by risk management |
| Light work, respiration volume = 10 m ³ /8-hour shift |
| Other given operational conditions affecting workers exposure |
| Outdoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings. |
| Technical conditions and measures at process level (source) to prevent release |
| Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling. |
| Technical conditions and measures to control dispersion from source towards the worker |
| None |
| Organizational measures to prevent/limit releases, dispersion and exposure |
| Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures. |
| Conditions and measures related to personal protection, hygiene and health evaluation |
| Use eye protection to EN 166 or ANSI Z87.1, designed to protect against liquid splashes. Wear suitable gloves tested to EN374 or complying with U.S. OSHA guidelines. |
| 3.3. Exposure estimation and reference to its source |

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

ASSESSMENT METHOD: CS1 and CS2: ECETOC TRA v.3

Information for CS1: Local releases to the environment

| Release | Release factor estimation method | Explanation / Justification |
|---------|----------------------------------|---|
| Water | Process and substance knowledge | Initial release factor: ERC2 assumes 2% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |
| Air | Process and substance knowledge | Initial release factor: ERC2 assumes 2.5% Final release factor: ~0.25% Local release rate: 62.5 kg/day across EU-27+. Explanation / Justification: Based on process knowledge. |
| Soil | Process and substance knowledge | Initial release factor: ERC2 assumes 0.01% Final release factor: 0% Local release rate: 0 kg/day Explanation / Justification: Substance is a liquefied gas. |

The exposure concentrations and RCRs for both HFO-1234yf and its potential degradation product TFA are covered and reported in ES4.

Information for CS2: Exposure concentrations and risks for worker

| Route of exposure and type of effects | Exposure concentration | Source for exposure concentration | Exposure concentration and DNEL (or DMEL) units | DNEL (or DMEL) | Risk characterisation |
|---------------------------------------|------------------------|--|---|----------------|-----------------------|
| Inhalation, systemic, long-term | 17 | TRA v.3 tool used to estimate exposure concentration | mg/m ³ | 950 | 0.018 |
| Inhalation, systemic, acute | Not needed | Not needed | | | Not needed |
| Inhalation, local, long-term | Not needed | Not needed | | | Not needed |
| Inhalation, local, acute | Not needed | Not needed | | | Not needed |
| Dermal, systemic, long-term | Not needed | Not needed | | | Not needed |
| Dermal, systemic, acute | Not needed | Not needed | | | Not needed |
| Dermal, local, long-term | Not needed | Not needed | | | Not needed |
| Dermal, local, acute | Not needed | Not needed | | | Not needed |
| Combined routes, systemic, long-term | | | | | 0.018 |

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

| | | | | | |
|--|--|--|--|--|------------|
| Combined routes, systemic, acute | | | | | Not needed |
| The RCR for inhalation exposure was <1. This indicates that adverse impact to workers is not expected. | | | | | |
| 4.1 Exposure Scenario ES4 | | | | | |
| Use, Service Life, and Waste Stage Environmental Exposure | | | | | |
| Industrial uses : Uses of substances as such or in preparations at industrial sites (SU3) ; Formulation [mixing] or preparations and/or re-packaging (excluding alloys) (SU10) ; General manufacturing, e.g.. machinery, equipment, vehicles, other transport equipment (SU17) excluding buses; Consumer uses : Private households (=general public = consumers) (SU21) ; and Professional uses : Public domain (administration, education, entertainment, services, craftsmen) (SU22). | | | | | |
| Contributing environmental scenario CS1: HFO-1234yf: Wide dispersive outdoor use in closed systems (ERC9b); TFA: Wide dispersive outdoor use of long-life articles, high or intended release (ERC 10b). | | | | | |
| Contributing worker scenarios: CS2: HFO-1234yf: Use and Service life (PROC 8a, 9) related to physico-chemical properties | | | | | |
| According to Henne et al., 2012, an estimated 19.2 Gg/yr (19 200 tonnes per annum (tpa)) of HFO-1234yf may be emitted to the air from MACs once the conversion to HFO-1234yf in the automobile fleet is complete and at a steady-state (estimated to occur in the year 2020). This value represents the high emission scenario (95% confidence band) for the EU-27+. The 19 200 tonnes estimated to be released per year was based on a predicted car fleet of about 335 million, approximately 90% of which have the substance in the MAC, and on all the lifecycle activities for the HFO-1234yf, except for chemical manufacturing, which does not presently occur in the EU-27+. | | | | | |
| 4.2.1 Contributing scenario CS1 controlling environmental exposure for ERC9b, 10b | | | | | |
| Wide dispersive use in closed systems (ERC9b); TFA: Wide dispersive outdoor use of long-life articles, high or intended release (ERC10b) | | | | | |
| See ES1, 2, 3 above, respectively for conditions of use covered by ES4. | | | | | |

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006



Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

Predicted yearly emissions based on Henne et al 2012 and ES3 estimated releases

| Activity | Potential amount released (g/MAC) | Percentage of original fill amount potentially released (%) | Fraction of automobiles with release | Henne et al emission factor (g/yr/MAC) | How Henne et al emission factor and/or fraction of automobiles with release determined | Predicted emissions for activity (tpa) |
|---|-----------------------------------|---|--------------------------------------|--|--|--|
| MAC filling at Original Equipment Manufacturers | 5 | 0.9 | 0.9 | 0.42 | 5 g/MAC divided by 12 years (average MAC lifetime) | 127 |
| MAC refilling by skilled personnel | 35 | 6.4 | 0.81 | 2.92 | 35 g/MAC divided by 12 years | 792 |
| MAC refilling by unskilled personnel | 350 | 64 | 0.09 | 29.2 | 350 g/MAC divided by 12 years | 880 |
| Regular automobile usage | 35.8 | 6.5 | 0.9 | 35.8 | In-use car data for 2002/2003 with no loss rate improvement | 10 794 |
| Irregular usage (sudden leaks from accidents, stone impacts, and component defects) | 550 | 100 | 0.017 | 550 | All or original fill released; 1.9% cars/year times 90% of cars with HFO-1234yf in MAC | 3 132 |
| MAC dismantling by skilled personnel | 100 | 18 | 0.25 | 8.33 | 100 g/MAC divided by 12 years | 698 |
| MAC dismantling by unskilled personnel | 400 | 73 | 0.25 | 33.3 | 400 g/MAC divided by 12 years | 2 789 |
| | | | | | <u>Total estimated emissions for ES1 and ES2</u> | ~19 212 |
| Formulation of preparations (ES3) | Not applicable | Not applicable | Not applicable | Not applicable | 0.25% of 5 000 tpa | 12.5 |
| | | | | | Total estimated emissions for ES1, ES2, and ES3 | ~19 225 |

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

4.2.2 Contributing scenario CS2 controlling worker exposure for Use and Service life (PROC 8a, 9) related to physico-chemical properties

Transfer of substance at non-dedicated facilities

Product characteristic

Extremely flammable liquefied gas; Covers percentage substance in the product up to 100 % (unless stated differently); Assumes activities are at ambient temperature (unless stated differently).

Amounts used

Mobile A/C: 0.5 kg/service event; Stationary Equipment: 0.05 – 300 kg/service event

Frequency and duration of use/exposure

Duration of use/exposure: Intermittent;
 Mobile A/C: ~1 minute/ 8-hour shift (0.083 minutes (5 seconds) per connecting process x 2 connecting processes per vacuuming/re-charging procedure x 1 servicing event per hour x 8 hours per shift)
 Stationary Equipment: ~< 1 minute/8-hour shift (0.083 minutes (5 seconds) per connecting process x2 connecting processes per vacuuming/ re-charging procedure x up to 4 servicing events per 8-hour shift)
 Frequency: 200 days/year

Human factors not influenced by risk management

None

Other given operational conditions affecting workers exposure

Indoor use; Under normal conditions of use, exposure would primarily occur when workers connect and disconnect the couplings.

Technical conditions and measures at process level (source) to prevent release

Ensure that the valves of the cylinders are tightly closed and not leaking; Handle substance within a closed system; Transfer via enclosed lines; Clear transfer lines prior to de-coupling.

Technical conditions and measures to control dispersion from source towards the worker

None

Organizational measures to prevent/limit releases, dispersion and exposure

Use of ATEX 137 and ATEX 95 Directives to mitigate flammability properties of HFO-1234yf and/or Chemical Substances at Work (Directive 98/24/EC); Use of ISO 13043 (April 15, 2011) (Road vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements) and SAE J639 (Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems), SAE J2843 (R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems) and SAE J2845 (Technician Certification for Service and Containment of Refrigerants Used in Mobile A/C Systems); EN 378 (Refrigerating systems and heat pumps – Safety and environmental requirements); Regular inspection and maintenance of equipment and machines.; Ensure operatives are trained to minimise exposures.

4.3. Exposure estimation and reference to its source

ASSESSMENT METHOD: CS1: ECETOC TRA v.3

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell**Solstice® yf Refrigerant (R-1234yf)**

Version 10.2

07.10.2017

Supersedes 9

Information for CS1:

Predicted exposure concentrations and risk characterisation ratios for HFO-1234yf:

| Protection target | Exposure concentration | Exposure concentration and PNEC units | PNEC | Risk characterisation |
|---------------------------------|------------------------|---------------------------------------|----------------|-----------------------|
| Sewage treatment plant (STP) | Not released to STP | mg/L | Not applicable | Not applicable |
| Freshwater | 1.11E-10 | mg/L | 0.1 | 1E-09 |
| Sediment (freshwater) | 1.67E-09 | mg/kg dry weight (dwt) | 1.77 | 9E-10 |
| Agricultural soil | 1.97E-09 | mg/kg dwt | 1.54 | 1E-09 |
| Marine water | 3.19E-11 | mg/L | 0.01 | 3E-09 |
| Sediment (marine water) | 4.81E-10 | mg/kg dwt | 0.178 | 3E-09 |
| Man via the environment (local) | 3.28E-06 | mg/kg body weight/day | 271 (DNEL)† | 1.21E-08 |

† The DNEL was derived by taking the worker inhalation, long-term, systemic DNEL of 950 mg/m³ and converting it to a dose by multiplying by a presumed daily inhalation rate of 20 m³/day and dividing by an adult body weight of 70 kg.

The RCRs for HFO-1234yf for all protection targets were all much less than 1. This indicates that adverse impact to the environment and environmental receptors is not expected from potential releases of HFO-1234yf during original filling, refilling, regular usage, irregular usage, and dismantling.

Predicted exposure concentrations and risk characterisation ratios for TFA if instantaneous conversion after HFO-1234yf vented to air:

| Protection target | Exposure concentration | Exposure concentration and PNEC units | PNEC (ECHA, 2014) | Risk characterisation |
|---------------------------------|------------------------|---------------------------------------|-------------------|-----------------------|
| Sewage treatment plant (STP) | Not released to STP | mg/L | Not applicable | Not applicable |
| Freshwater | 1.06E-05 | mg/L | 1 | 1E-05 |
| Sediment (freshwater) | 5.86E-05 | mg/kg dry weight (dwt) | 4.22 | 1E-05 |
| Agricultural soil | 9.23E-06 | mg/kg dwt | 0.0083 | 1E-03 |
| Marine water | 9.14E-05 | mg/L | 0.1 | 9E-05 |
| Sediment (marine water) | 5.03E-05 | mg/kg dwt | 0.422 | 1E-04 |
| Man via the environment (local) | 1.12E-04 | mg/kg body weight/day | 0.25 (DNEL) | 4E-04 |

The RCRs for TFA for all protection targets were all much less than 1. This indicates that adverse impact to the environment and environmental receptors is not expected from the potential conversion of HFO-1234yf to TFA during original filling, refilling, regular usage, irregular usage, and dismantling.

Assessment method for CS2: SAE International Cooperative Research Program 1234

Information for CS2:

Predicted exposure concentrations and physicochemical risk characterisation evaluation

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Honeywell

Solstice® yf Refrigerant (R-1234yf)

Version 10.2

07.10.2017

Supersedes 9

HFO-1234yf is classified as an extremely flammable gas. This classification is based solely on the existence of a lower and upper flammability limit in air at 20°C. The flammability limits in air are 6.2%(V) and 12.3%(V) (method: ASTM E681-04). HFO-1234yf has a boiling point of -29,4 °C and an autoignition temperature of 405°C. The auto-ignition temperature is very high and is of no concern during normal handling and use.

As HFO-1234yf is not classified as dangerous on the basis of (eco) toxicological properties, only the risk due to its flammable properties is required to be characterized. Exposure to HFO-1234yf within the confines of an automobile as a consequence of leaks due to random collisions is the worst-case situation as higher concentrations are more easily attained because HFO-1234 may escape in a shorter period of time than during a corrosion-type leak. Again, following a collision situation, a Micro automobile with effective volume of 1.25 m³ was used to determine if the refrigerant's lower flammability level would be attained. In the most severe situation, 70% of the refrigerant is potentially leaked into the passenger cabin after a side impact collision. According to SAE J2772, breakage of other components would more likely lead to a significant release of refrigerant to the ambient air rather than to the passenger cabin. Results from this evaluation suggest that the refrigerant reaches a maximum concentration of 127 000 mg/m³ (27 200 ppm), well below the lower flammability level of 62 000 ppm.

Exposure to HFO-1234yf due to worst-case corrosion-type leaks (slower gradual leaks) has been shown to reach a maximum concentration of below 2% in the luxury vehicle (maximum was 1.8% as tested); typical commuter vehicles have higher body air leakage and thereby lower maximum refrigerant concentrations (maximum was 1.2% as tested) than luxury vehicles due to the reduced road noise requirement for the higher end vehicles.