

Auszug aus dem Vortrag

NAT-KM FACHTAGUNG 2018
LFU, DKV , ÖKO-RECHERCHE



SOFTWAREGESTÜTZTE BESTIMMUNG DER ZULÄSSIGEN
KÄLTEMITTEL- UND STANDORTABHÄNGIGEN
FÜLLMENGENGRENZEN NACH EN 378

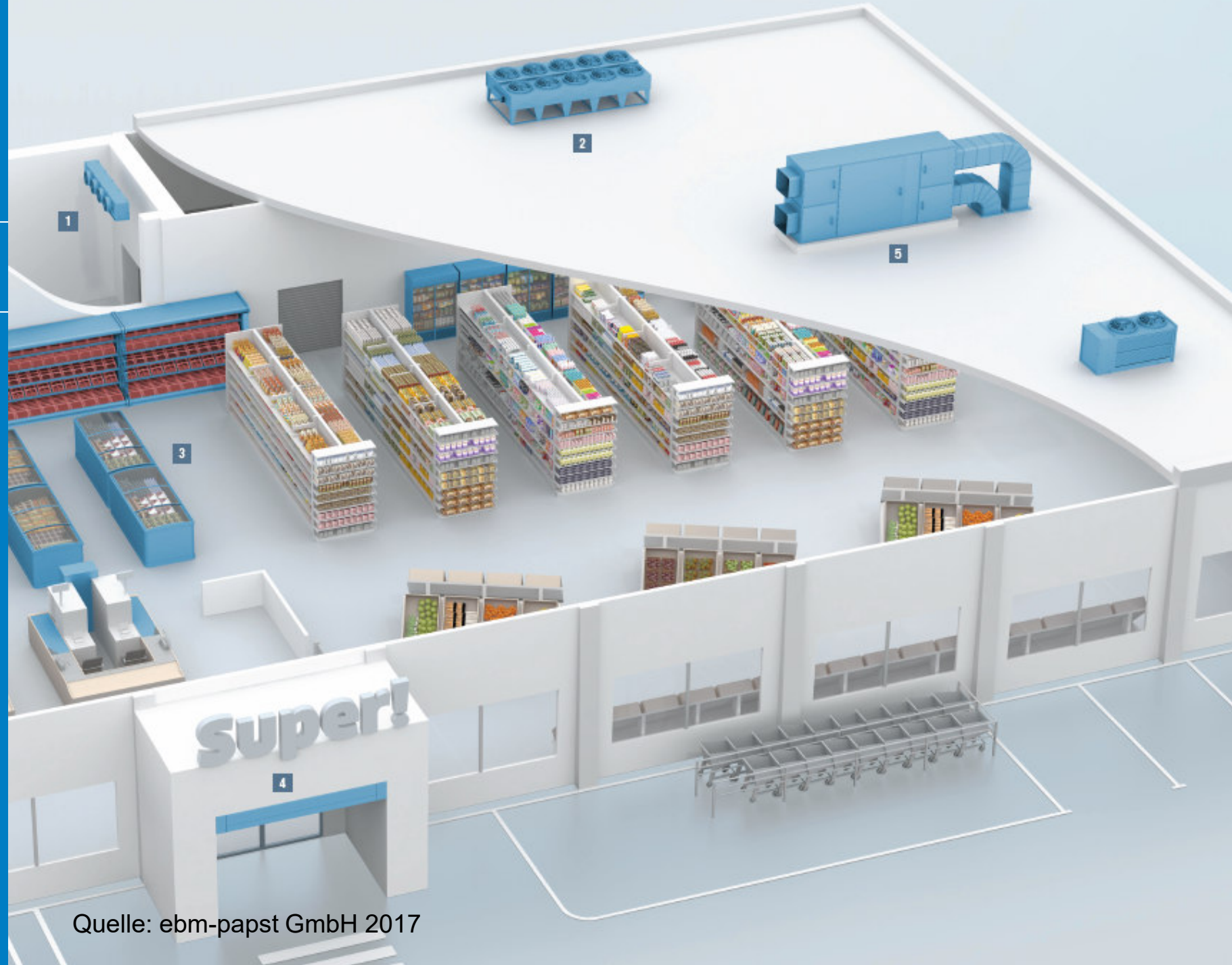
GERHARD FREI
COOLING ENGINEER

www.coolplan.eu

Nürnberg, 12.11.2018

THEMEN

- ≡ KÄLTEMITTEL
- ≡ EN 378 VERFAHREN
- ≡ FÜLLMENGE
- ≡ FAZIT



KÄLTEMITTEL

DEFINITION

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Primärenergie - Kältemittel Herstellung

180
160
140
120
100
80
60
40
20
0

■ MJ/kg

≡ KÄLTEMITTEL

- Herstellung
- Chemischer Prozess

≡ NATÜRLICHE KM

- Herstellung
- Natürlicher Prozess

≡ ALTERNATIVE KM

- Herstellung
- Chemischer Prozess

KÄLTEMITTEL

DEFINITIONEN

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LFL

Untere Explosionsgrenze [kg/m³]

ODL

Grenzwert für Sauerstoffmangel [kg/m³]

ATEL

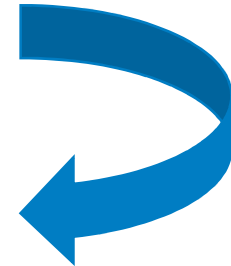
Expositionsgrenzwert für die akute Toxizität [kg/m³]

RCL

Max. zulässige Kältemittelkonzentration (prakt. Grenzwert) [kg/m³]

EN378

Toxizitätsgrenze nach EN378 = Größte Wert (ODL, ATEL oder RCL)



KÄLTEMITTEL

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PED 1

DGRL Fluidgruppe 1 = gefährliches Fluid

PED 2

DGRL Fluidgruppe 2 = alle anderen Fluide

H221

Entzündbares Gas (Sicherheitsdatenblatt)

H220

Extrem entzündbares Gas (Sicherheitsdatenblatt)

GHS

Global harmonisiertes System zur Einstufung und Kennzeichnung von Chemikalien

KÄLTEMITTEL

EINSTUFUNG NACH EN 378 (ISO 817)

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| | KLASSE Fluid | PED DGRL | GHS Brennbarkeit | GWP (AR5) | SIEDEPUNKT °C (1 Bar) | ATEL kg/m³ |
|---------|-----------------|-------------|---------------------|--------------|--------------------------|---------------|
| R744 | A1 | 2 | | 1 | - 78 | 0,072 |
| R717 | B2L | 1 | | 0 | - 33 | 0,00022 |
| R723 * | B2 | 1 | | 8 | - 36,6 | NN |
| R290 | A3 | 1 | | 3 | - 42 | 0,09 |
| R1270 | A3 | 1 | | 2 | - 48 | 0,0017 |
| R32 | A2L | 1 | | 677 | - 52 | 0,30 |
| R1234yf | A2L | 1 | | < 1 | - 26 | 0,47 |
| R1234ze | A2L | 2 | | < 1 | - 19 | 0,28 |

* kein ISO 817 KM

EN 378 VERFAHREN

EN 378

ANFORDERUNGEN AN DIE KM GRENZWERTE

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≡ VEFAHREN NACH EN 378 | Teil 1 | Anhang C.1





TOXIZITÄT



A

B

TABELLE
C.1

BRENNBARKEIT



1

2

2L

3

TABELLE
C.2



KÄLTEANWENDUNG

a

ZUGANGSBEREICH

ALLGEMEIN

- 1 Personenaufenthaltsbereich
- 2 Unkontrollierter Zutritt



b

ZUGANGSBEREICH

ÜBERWACHT

- 1 Sicherheitsvorkehrung vertraut
- 2 Begrenzter Zutritt



c

ZUGANGSBEREICH

BEFUGT

- 1 Sicherheitsvorkehrung vertraut
- 2 Begrenzter Zutritt

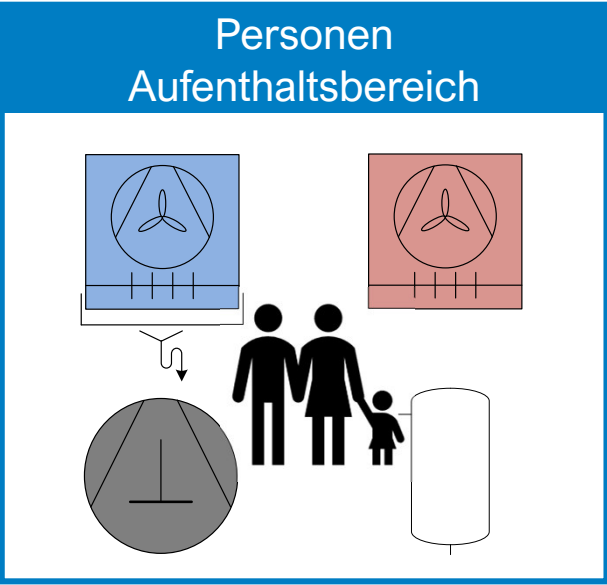




KÄLTEERZEUGUNG

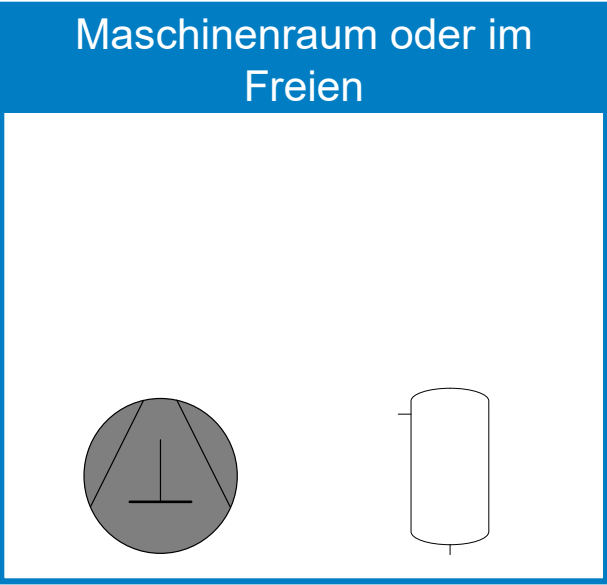
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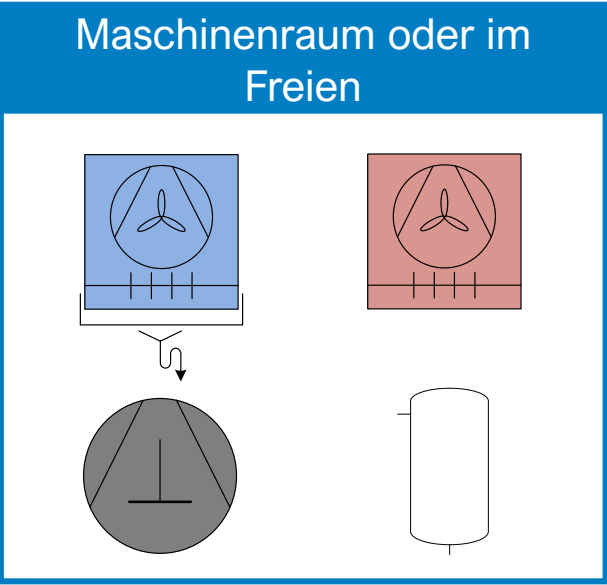
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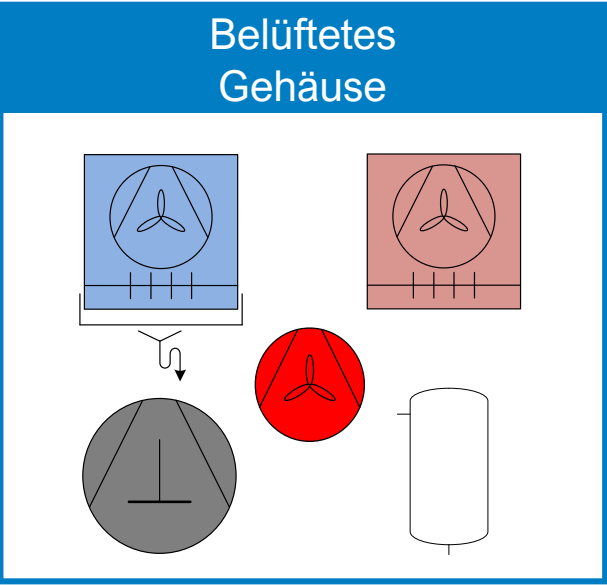
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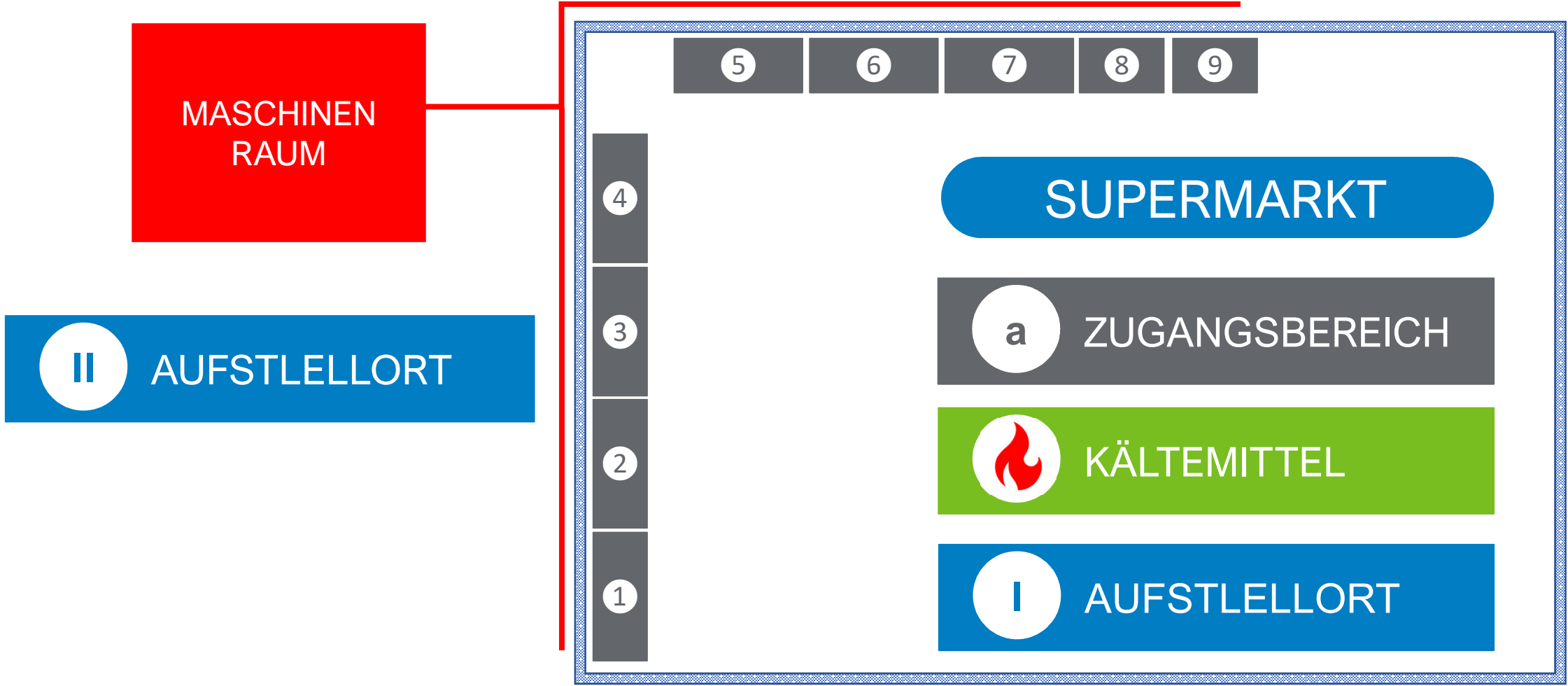
IV

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EN 378

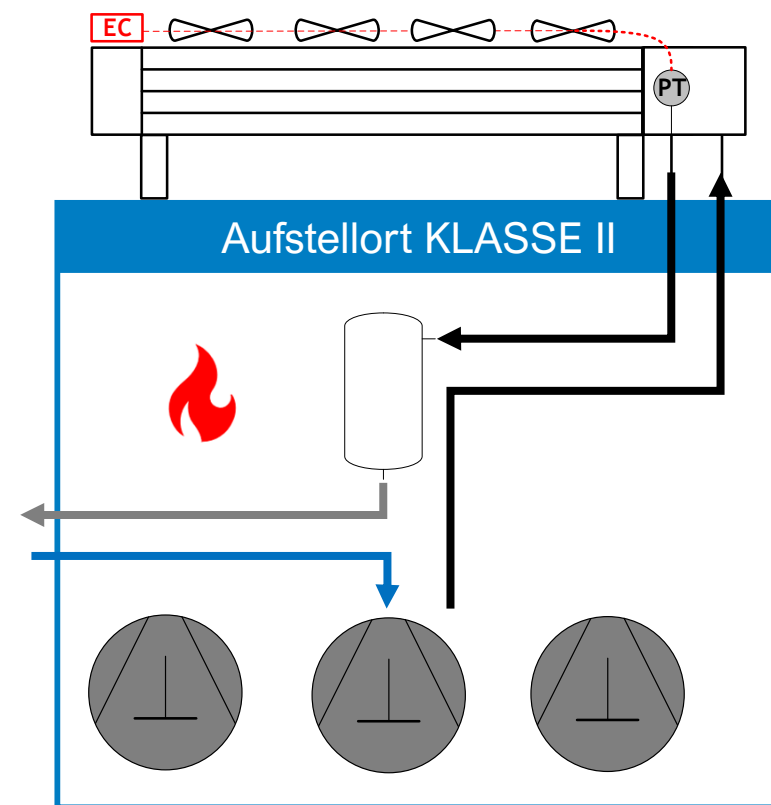
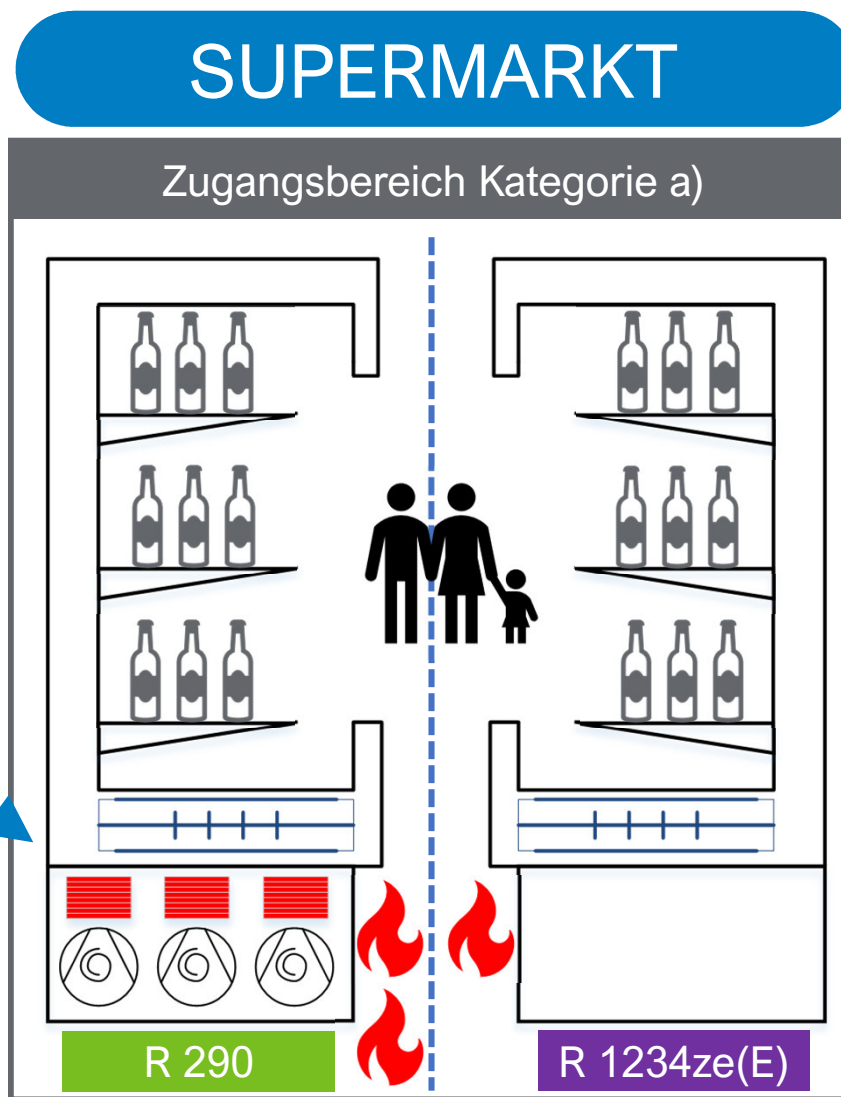
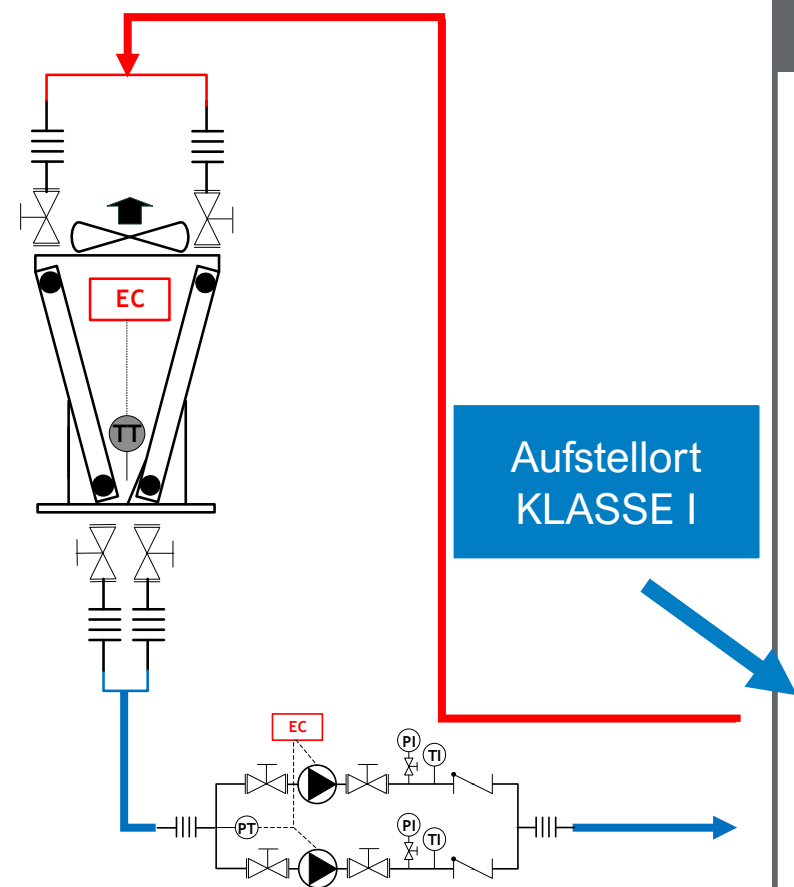
ZUGANSBEREICH & AUFSTELLORT



EN 378

AUFSTELLORT VERGLEICH

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EN 378 | TEIL 1 | TABELLE C.1

FÜLLMENGEN GRENZWERTE TOXIZITÄT

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[illegible]

EN 378 | TEIL 1 | TABELLE C.2

FÜLLMENGEN GRENZWERTE A2L

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EN 378 | TEIL 1 | TABELLE C.2

FÜLLMENGEN GRENZWERTE A3

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Software | Füllmengenbestimmung | EN378




Table content is obscured by a large blue rectangle.

EN 378

COOLPLAN SOFTWARE TOOL





www.coolplan.eu

COOLPLAN EN378 FMT

BETA 19

Projekt

| | | |
|-------------|-------------|-------|
| Datum | 11.11.2018 | 13:24 |
| Anwender | COOLPLAN | |
| Kunde | LfU | |
| Projekt | DKV Vortrag | |
| Bezeichnung | EN378-V01 | |

REPORT

EMPFOHLENER FÜLLMENGEN GRENZWERT

NACH DIN EN 378-1:2018-04

Kälteanwendung

| | |
|---------------------|----------------|
| Nutzung | GEWERBEKÄLTE |
| Anwendung | Supermarkt |
| Geschosszugang | Mit Notausgang |
| Raum Zugangsbereich | Oberirdisch |

ZUGANGSBEREICH

ALLGEMEIN

KATEGORIEa

SupermarktREF

Kältesystem

| | |
|---------------|------------------------------|
| Kältemittel | R1234ze |
| KM Ausführung | teilweise feste Verbindungen |
| Kalte Seite | Direkt - Verdampfung |

AUFSTELLUNGORT

R1234ze

KLASSIFIKATIONII

Maschinenraum oder im Freien

EN 378

FÜLLMENGENGRENZE & VERZÄHNUNG



ANWENDUNG

Kälte
Klima
WRG
Laufzeit
Aufstellort
Produktqualität



KÄLTEMITTEL

DGRL
Effizienz
Brennbarkeit
Einsatzgrenzen
Vol. Kälteleistung
Füllmenge/Grenze



KONZEPT

tc min
DX / Sole
Verdichter
Rohrleitung
Komponenten
Risikobeurteilung



BETRIEB

Kosten
BetrSichV
ATEX Zone
Nachhaltigkeit
Total LCC Analyse
Gefährdungsbeurteilung



≡ HERSTELLER

- RISIKOBEURTEILUNG
- Individuelle Planung erforderlich
- Genaue Füllmengenberechnung im Vorfeld
- System Konzept und Lösung ist erfahrungsabhängig!



≡ BETREIBER

- GEFÄHRDUNGSBERURTEILUNG
- Kältetechnisches Wissen?
- Kältemittel, Gesetzte, Unterweisung?
- Effizienz, Investment, Kaufkriterium?



≡ EN 378

- State of the Art ?
- Nicht vollständig!
- Norm und Richtungs Vorgabe!
- Ist/kann die Grundlage für Angebot und Auftrag sein?!

TRAINING IM KONZEPTDESIGN
ist ein Muss!



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