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SUOMEN RAKMK:N JA NFPA:N MUKAISTEN HÄTÄPOISTUMISTEITÄ KOSKEVIEN PALOMÄÄRÄYSTEN VERTAILU

Diesel- ja kaasumoottorivoimalaitoksiin soveltuvat määräykset

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Tutkimuksen tarkoituksena on vertailla Suomen rakentamismääräyskokoelman ja National Fire Protection Associationin mukaisia palomääräyksiä poistumisteiden osalta. Näissä keskitytään ainoastaan diesel- ja kaasumoottorivoimalaitosten moottorihalliin sovellettaviin määräyksiin. Tutkimus suoritettiin yhteistyössä Wärtsilä Power Plantsin kanssa.

Palon sattuessa rakennuksesta on voitava poistua nopeasti ja turvallisesti. Tähän vaikuttavat uloskäytävien lukumäärä, koko ja etäisyys. Lisäksi kulkureitin tulee olla selkeä ja helppokulkuinen. Uloskäytävät tulee suojata tulelta sekä merkitä ja valaista, jotta poistuminen rakennuksesta on sujuvaa.

Suomen rakentamismääräyskokoelmassa annetaan ohjeita rakentamiseen. Nämä ohjeet ovat velvoittavia Suomessa rakennettaessa. National Fire Protection Association on yhdysvaltalainen järjestö, joka laatii paloturvallisuuteen liittyviä ohjeita.

Tutkimus tehtiin taulukkomuodossa ja jaoteltiin teorian mukaisiin aihepiireihin. Tutkimus koski vain moottorihalliin sovellettavia määräyksiä, mistä johtuen vertailluista määräyksistä osa rajautui tutkimuksen ulkopuolelle.

Suomen rakentamismääräyskokoelma antaa määräyksiä lähinnä uloskäytävien lukumäärään, kokoon ja etäisyyksiin liittyen. Myös uloskäytävien palosuojaukset on määritelty. Muilta osin määräykset ovat melko pinnallisia. National Fire Protection Associationin ohjeet antavat tarkemmat raamit joka aihepiirissä. Toisin kuin Suomen rakentamismääräyskokoelma, National Fire Protection Association käsittelee yksityiskohtaisesti myös kulkureitin turvallisuuteen, merkitsemiseen ja valaistukseen liittyviä aihepiirejä. Siltä osin kuin Suomen rakentamismääräyskokoelma antaa tarkan määreen poistumistielle, on se usein National Fire Protection Associationia tiukempi.

Avainsanat Suomen rakentamismääräyskokoelma, NFPA, hätäpoistumistiet, palomääräykset, voimalaitos

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ABSTRACT

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Title	Suomen RakMK:n ja NFPA:n mukaisten hätäpoistumisteitä koskevien palomääräysten vertailu – Diesel- ja kaasumoottorivoimalaitoksiin soveltuvat määräykset
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The purpose of the study was to compare the fire regulations for means of egress in National Building Code of Finland and National Fire Protection Association. In means of egress standards the focus was on the regulations that can be applied on engine halls to diesel- and gas power plants. The study was conducted in cooperation with Wärtsilä Power Plants.

When a fire occurs, it must be possible to exit from the building fast and in a safe way. This is affected by the number and size of exits as well as distance to exits. In addition, the route should be easily accessible. Exits should be protected from fire and they should be marked and illuminated properly to make the exit easier.

The National Building Code of Finland gives rules and regulations on construction work. These rules and regulations are binding. National Fire Protection Association is an organisation in United States, which compiles regulations related to fire safety.

The comparison was made in a table format and was divided into subjects according to the theoretical background. The comparison only concerned engine halls, therefore, some parts of the compared regulations were excluded in this comparison.

The National Building Code of Finland gives merely regulations on the number and size of exits, and distance to exits. There are also adequate regulations on exit enclosure fire resistance. Other than that, the regulations are pretty vague. National Fire Protection Association regulations give more strict rules on every subject. Contrary to the National Building Code of Finland, National Fire Protection Association gives detailed regulations even on exit access, exit marking and illumination of exits. Where the National Building Code of Finland gives explicit regulations, they are is mostly a bit stricter than those of National Fire Protection Association.

Keywords	National Building Code of Finland, NFPA, means of egress, fire regulations, power plant

SISÄLLYS

KUVIO- JA TAULUKKOLUETTELO

LIITELUETTELO

LYHENTEET

A2	Rakennustarvikeluokka – tarvikkeet, joiden osallistuminen paloon on erittäin rajoitettu (RakMK)
ANSI	American National Standards Institute
CE	Conformité Européenne
d0	Palavan pisaroinnin luokitus – palavia pisaroita tai osia ei esiinny (RakMK)
EI 30	Tiiviys ja eristävyys 30 minuuttia (RakMK)
EN	Euronormi
EPC	Engineering, procurement, construction
K2 30	Suojaverhousluokka 2, 30 minuuttia (RakMK)
LNG	Liquefied natural gas (nestemäinen maakaasu)
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
P1, P2, P3	Paloluokka 1/2/3 (RakMK)
R30, R60	Kantavuus 30 minuuttia / 60 minuuttia (RakMK)
RakMK	Suomen rakentamismääräyskokoelma
s1	Savuntuottoluokitus – savun tuotto on erittäin vähäistä (RakMK)

1 JOHDANTO

Rakentamisessa ympäri maailmaa noudatetaan sekä kansainvälisiä että kansallisia standardeja ja määräyksiä. Joissakin valtioissa on sitouduttu seuraamaan tiettyä kansainvälistä standardia, jonka lisäksi valtiossa voidaan laatia omia tarkennuksia standardiin tai standardin vaatimuksia tiukempia määräyksiä. Esimerkiksi Euroopan alueella noudatettavat Eurokoodit edellyttävät kansallisten liitteiden laatimista (Tietoa Eurokoodeista 2014).

Yksi rakennusten suunnittelussa huomioon otettava osa-alue ovat palomääräykset. Palomääräyksiä käsitellään rakentamiseen liittyvissä määräyksissä, kuten Suomessa Suomen rakentamismääräyskokoelmassa (RakMK), mutta myös monissa muissa standardeissa ja määräyksissä. Esimerkiksi Yhdysvalloissa paloturvallisuutta käsitteleviä standardeja ovat mm. Occupational Safety and Healt Administration (OSHA) ja National Fire Protection Association (NFPA). OSHA:ssa määritellään työantajan velvollisuuksista työntekijän turvallisuuden ja terveyden turvaamiseksi (At-a-Glance OSHA 2014). NFPA käsittelee yksinomaan paloturvallisuutta (NFPA Overview 2014). Tämä opinnäytetyö vertaa näistä kahden, eli Suomen rakentamismääräyskokoelman sekä National Fire Protection Associationin palomääräyksiä.

Seuraavaksi käsitellään tutkimuksen ongelma-asettelu ja tavoite sekä esitellään yhteistyöyritys Wärtsilä Oyj keskittyen Power Plants -organisaatioon. Toisessa kappaleessa käydään läpi palomääräysten erityispiirteitä ja sekä poistumistiet pääpiirteittäin. Lisäksi toisessa kappaleessa esitellään lyhyesti Suomen rakentamismääräyskokoelma ja National Fire Protection Association. Kolmannessa kappaleessa kerrotaan miten vertailu on käytännössä toteutettu. Neljäs kappale käsittelee vertailun tuloksia ja lopuksi viides kappale näiden tulosten perusteella tehdyt johtopäätökset.

1.1 Ongelma-alue

Kansainvälisen yrityksen, joka suunnittelee rakennuksia tai rakentaa eri puolella maailmaa, tulee ottaa huomioon eri maissa vallitsevat määräykset. Toisaalta, kun halutaan rakentaa kustannustehokkaasti ja tuottaa kilpailukykyisiä ratkaisuja asiakkaille, ovat vakioratkaisut tarpeen. Vakioratkaisut eivät kuitenkaan aina sovi yhteen eri määräysten kanssa. Jos esimerkiksi suomalainen yritys suunnittelee vakioratkaisun Eurokoodien mukaan, Yhdysvalloissa tämä ratkaisu ei välttämättä ole hyväksyttävissä, koska siellä noudatetaan eri standardeja. Jos eri standardit määräävät hyvin erilaiset ratkaisut, on joko luovuttava vakioratkaisun suunnittelemisesta, tehtävä alue- tai maakohtaiset vakioratkaisut tai valittava yksi standardi, jonka pohjalta vakioratkaisu suunnitellaan.

Jos päädytään viimeiseen vaihtoehtoon, on vaihtoehtoja käytännössä kaksi, kun rakennetaan alueelle, jossa vakioratkaisun suunnitteluun käytetyt standardit eivät ole voimassa. Yksi vaihtoehto on suunnitella alusta asti uusi rakennus. Toinen vaihtoehto on tarkistaa, miltä osin standardit eroavat toisistaan ja tehdä muutoksia vakioratkaisuun tarpeen mukaan. Mikäli rakennetaan paljon esimerkiksi kahden eri standardin mukaan, voidaan toki myös suunnitella ratkaisu, joka täyttää kummankin standardin mukaiset vaatimukset. Tällainen ratkaisu ei välttämättä ole mahdollinen tai kustannustehokas, jos standardit poikkeavat paljon toisistaan.

Diesel- ja kaasumoottorivoimalaitoksessa kohdistuu nk. moottorihalliin useita vaatimuksia jo pelkästään käyttötarkoituksen perusteella. Esimerkiksi moottoreiden ympärillä on oltava huoltotilaa, perustus on tehtävä moottorin rasitusta kestäväksi, moottorit on sijoiteltava niin, että niiden on mahdollista toimia moitteettomasti, moottorit on voitava poistaa hallista niiden käyttöiän päätyttyä jne. Koska rakennuksen käyttötarkoitus diesel- ja kaasumoottorivoimalaitoksissa antaa raamit rakennuksen muodolle ja sijoittelulle, voidaan olettaa, että vallitsevan normin vaihtuessa on helpompi mukauttaa aikaisemmin suunniteltu rakennus uuden standardin mukaiseksi kuin suunnitella täysin uusi. Lähtökohtaisesti tulisi tunnistaa, mitkä ovat suurimmat erot standardien välillä ja miten ne vaikuttavat.

Kun voimalaitoksen energianlähteinä käytetään helposti syttyviä aineita, kuten öljy, maakaasu sekä erinäiset biopolttoaineet, on rakennuksen paloturvallisuus tärkeässä asemassa, mutta onko myös paloturvallisuuteen liittyvissä standardeissa suuria eroja? Miten eurooppalaisten normien mukaan suunnitellun rakennuksen paloturvallisuussuunnitelmat poikkeavat yhdysvaltalaisten standardien vaatimuksista?

1.2 Tavoite

Koska palomääräykset ovat laaja aihepiiri, keskitytään tässä työssä vain hätäpoistumisteitä koskeviin määräyksiin. Työn tavoitteena on laatia vertailu eurooppalaisen ja yhdysvaltalaisen standardin välillä. Euronormien ja Eurokoodin paloturvallisuuteen liittyvät standardit eivät kuitenkaan käsittele juuri hätäpoistumisteihin liittyviä ohjeita. Tästä syystä vertailuun on käytetty Suomen rakentamismääräyskokoelman poistumisteitä koskevia määräyksiä. Näitä verrataan Yhdysvaltalaiseen National Fire Protection Associationin standardeihin. Vertailussa keskitytään diesel- ja kaasuvoimalaitosten moottorihalliin sovellettaviin määräyksiin. Vertailusta tulisi ilmetä, miltä osin standardit yhtenevät ja miltä osin ne poikkeavat toisistaan. Vertailun tuloksia hyväksi käyttäen pystytään havaitsemaan, mitä muutoksia moottorihalliin on tehtävä, jotta se täyttäisi NFPA:n mukaiset vaatimukset. Tarkempaa tietoa rajauksista löydät kappaleesta 3.2 Rajaukset.

1.3 Wärtsilä Oyj – Power Plants

Wärtsilä Oyj on suomalainen yritys, joka tarjoaa ratkaisuja sekä meri- että energia-alalle. Wärtsilän pääkonttori sijaitsee Helsingissä, mutta yritys toimii maailmanlaajuisesti. Konttoreita sijaitseekin jokaisessa maanosassa, 70:ssä eri maassa. Yhteensä työntekijöitä on vajaat 18 000. Vuonna 2014 Wärtsilän liikevaihto oli n. 4,8 miljardia euroa. (This is Wärtsilä 2015.)

Wärtsilän liiketoiminta on jaettu kolmeen eri alueeseen – Ship Power, Power Plants ja Services. Ship Power tuottaa koneisto-, propulsio- ja ohjauslaitteistoja merenkulkuun sekä öljy- ja kaasuteollisuuden off-shore tarpeisiin. Moottorit,

alennusvaihteet, propulsiolaitteet, ohjausjärjestelmät ja tiivisteet ovat esimerkkejä tarjonnasta. Power Plants toimintayksikkö toimittaa kaasuilla tai nestemäisillä polttoaineilla toimivia voimalaitoksia sekä perusvoiman tuottoon, huippukuormituksien tasaamiseen että teollisuuden omaan käyttöön. Sen lisäksi tarjontaan kuuluu LNG (nestemäinen maakaasu) terminaalit ja jakeluyksiköt. Service huoltaa sekä Ship Powerin että Power Plantsin laitteistoa tarjoten asiakkaille tukea koko laitteiston eliniän ajan. Huoltosopimukset eivät kuitenkaan rajoitu vain Wärtsilän omiin tuotteisiin. (This is Wärtsilä 2015.)

Power Plants toimintayksikön liikevaihto oli runsaat 1,1 miljoonaa euroa vuonna 2014. Työtekijöitä oli vajaa tuhat. (This is Wärtsilä 2015) Voimalaitosten voimantuotanto perustuu polttomoottoreihin. Voimalaitoksia on rakennettu jo yli 4 700 kappaletta yli 170 maahan. Voimalaitosten koko vaihtelee 10 MW:sta 600 MW:iin, toimitussisältö laitetoimituksista ns. EPC (engineering, procurement, construction; suom. suunnittelu, osto, rakennus) toimituksiin. (Power Plants 2015) EPC vastaa siis ”avaimet käteen” periaatetta.

Koska Power Plantsin toiminta on kansainvälistä, tulevat eri standardit esiin voimalaitosten suunnittelussa. Varsinkin myyntivaiheessa aika on usein hyvin rajallista, ja standardien aiheuttamat muutokset pitää selvittää nopeasti, jotta kustannusarviot voidaan tehdä mahdollisimman tarkasti. Tässä työssä suoritetun vertailun avulla on tarkoitus edesauttaa varsinkin myyntivaiheessa tapahtuvaa suunnittelua ja siten myös kustannusarviointia.

2 TEOREETTINEN TAUSTA

Tässä osiossa käsitellään palomääräysten syntyä ja merkitystä paloturvallisuuden kannalta sekä paloturvallisuuteen liittyen poistumisteiden piirteitä. Ensiksi kuitenkin kerrotaan mitä tulipalo merkitsee erityisesti diesel- ja kaasuvoimalaitoksissa. Lopuksi esitellään lyhyesti Suomen rakentamismääräyskokoelma ja National Fire Protection Association.

2.1 Tulipalo diesel- ja kaasuvoimalaitoksissa

Tulipalon syttyminen ja tulen ylläpito noudattaa luonnonlakeja, joiden tunteminen ja ymmärtäminen ovat edellytyksiä palon hallinnan kannalta. Tulipalon syttymiseen tarvitaan palava aines (polttoaine), lämpöä sekä happea. Itse palaminen on kemiallinen reaktio, jossa palava aines hapettuu. Tulipalossa reaktio on nopea tuottaen valoa ja lämpöä. Mikäli kemiallista reaktiota ei tapahdu, eli mikäli palava aines, happi tai riittävä lämpö puuttuu, ei tuli syty. Jos jokin näistä poistetaan (loppuu) palon aikana, tuli sammuu. (Schroll 2002, 10)

Diesel- ja kaasuvoimalaitoksissa polttoaineina käytetyt nesteet ja kaasut ovat helposti syttyviä ja palo leviää nopeasti. Toisin kuin kiinteät aineet - kuten puu - nesteet ja kaasut pääsevät liikkumaan vapaasti, ja siksi niistä aiheutuvien tulipalojen hallinta on vaikeampaa. Lisäksi voimalaitoksissa on sähköisiä laitteita, joiden vikatilanteet tai väärinkäyttö saattaa aiheuttaa mm. sähköpiiriin resistanssin, josta syntyvä lämpö voi sytyttää palavan aineen. Sähköiset laitteet taikka sähkö eivät kuitenkaan itsessään pala. (Schroll 2002, 10–11)

2.2 Palomääräykset

Tulipaloista aiheutuvien rahallisten vahinkojen määrä on lisääntynyt huomattavasti viime vuosisadan aikana. Samalla palotorjuntaan käytetään entistä enemmän rahaa. Tulipaloista johtuneiden kuolemien määrä on onneksi vähentynyt hieman. (Schroll 2002, 1) Kuolonuhrien määrää maailmanlaajuisesti on kuitenkin vaikea arvioida, koska kaikissa maissa ei ole aikaisempia tilastoja tai valtiot eivät anna luotettavia tietoja uhrien määrästä (Cote, Hall, Powell & Grant 2003, 2-7–

11). Suurin osa henkilövahingoista tapahtui asuinrakennuksissa. Kaikista vahingoista voidaan kuitenkin oppia, ja ne ovatkin hyvä tiedon lähde pyrittäessä estämään vastaavia tapahtumia tulevaisuudessa. (Schroll 2002, 1)

Tavallisesti paloista aiheutuvat vahingot jaetaan henkilö-, suoriin- ja välillisiin vahinkoihin. Henkilövahingot ovat sekä loukkaantumisia että kuolemantapauksia. Niistä aiheutuu sekä rahallisesti mittaamattomissa olevia vahinkoja, kuten kipu, tuska ja suru, että rahallisia vahinkoja, kuten lääkärikustannukset, vammaistuet ja muut mahdolliset edut. Suorat vahingot ovat rakennuksiin, laitteisiin ja huonekaluihin aiheutuvat vahingot. Nämä ovat paitsi tulipalosta aiheutuvia vahinkoja, myös savu- ja vesivahinkoja. Välilliset vahingot ovat mm. tuotannon keskeytymisestä johtuvat kustannukset, kaupan väliaikaisesta sulkemisesta johtuvat kustannukset ja palossa tuhoutuneiden tietojen uudelleen tuottamisesta aiheutuvat kustannukset. Välillisiä kustannuksia kuitenkin harvoin huomioidaan, kun lasketaan palosta aiheutuvia kustannuksia. (Schroll 2002, 1–2.)

Tulipaloista aiheutuvien vahinkojen vähentämiseksi on kehitetty eri keinoja ja suunnitelmia niitä ennalta ehkäisemään. Lähtökohtana on, että ennaltaehkäisy on edullisempaa kuin tulipalon jälkeisten vahinkojen kustannukset. (Schroll 2002, 27) Jotta varmistetaan paloturvallisuuden huomioon ottaminen eri organisaatioissa, on laissa ja standardeissa asetettu vähimmäismääräyksiä. Standardien noudattaminen voi olla vapaaehtoista tai laissa vaadittua. (Schroll 2002, 28–29)

Yhdysvalloissa laissa määrätään ensisijaisesti tulipalojen vaikutuksista henkilöturvallisuuteen ja vasta toissijaisesti vaikutuksista omaisuuteen. Occupational Health and Safety Administartion (OSHA) on Yhdysvalloissa ensisijainen paloturvallisuudesta määräävä liittovaltionvirasto. OSHA keskittyy kuitenkin ainoastaan työntekijöiden paloturvallisuuteen ottamatta huomioon omaisuutta tai ympäristölle (naapurustolle) aiheutuvia vahinkoja. (Schroll 2002, 28–29) National Fire Protection Association on Yhdysvaltalainen organisaatio, jotka laatii yksinomaan paloturvallisuuteen liittyviä standardeja (NFPA overview 2014). NFPA on esitelty tarkemmin kappaleessa 2.3.

Euroopasta ei löydy NFPA:ta vastaavaa kattavaa paloturvallisuusstandardia. Eurokoodit puuttuvat rakenteiden palosuunnitteluun, kuten kestävyyteen ja kantavuuteen palotilanteissa (Kruppa 2008). Euronormeista löytyy paloturvallisuuteen liittyvää laitteistoa, kuten palohälyttimiä, koskevia standardeja, esim. EN 3 Portable fire extinguishers ja EN 54 Fire detection and fire alarm systems ja paloluokitukseen liittyviä normeja, kuten EN 2 Classification of fire ja EN 13501 Fire classification of construction products and building elements. Suomessa rakennuksen paloturvallisuuteen liittyviä määräyksiä annetaan rakentamismääräyskokoelman osiossa E Rakenteellinen paloturvallisuus.

2.3 Poistumistiet

Palotilanteissa, kuten muissa hätätilanteissa, tapahtuman kulkua voidaan kuvata seuraavaa polkua seuraamalla:

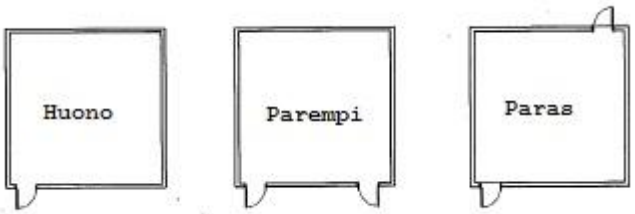
Hätätilanne (tulipalo) → tietoisuus tilanteesta → toimenpiteiden tarpeen arviointi.

Tulipalo on hätätilanne, joka seuraavassa vaiheessa havaitaan. Palon havaitsemisen helpottamiseksi käytetään nykyään rakennuksissa palovaroittimia. Mikäli todetaan, että vaaratilanne vaatii toimenpiteitä, valitaan asianmukainen menettelytapa. Nämä voidaan jakaa kolmeen ryhmään: 1. paikalta pakeneminen, 2. avun odottaminen tai 3. hätätilanteen hallitseminen. Paettaessa tulee tiedostaa eri poistumisreitit, valita niistä sopivin ja poistua näiden kautta rakennuksesta. Apua odotettaessa valitaan suojapaikka, pyritään turvaamaan paikka vaaralta ja jäädään sinne odottamaan. Tällaisessa tilanteessa avunantajille – tulipalossa palolaitokselle – tulisi tiedottaa oma olinpaikka. Hätätilanteen hallitseminen viittaa esimerkiksi palon sammuttamiseen omin keinoin tai palon leviämisen estämiseen käytettyjä keinoja. (Shcroll 2002, 54–56) Tässä kappaleessa käsittelemme poistumisteitä, jotka liittyvät vaihtoehdoista ensimmäiseen.

Poistumistiet koostuvat kolmesta osasta:

1. Poistumisalue, eli mikä tahansa alue rakennuksessa, josta pyritään poistumaan, kuten toimistot, teolliset toimitilat, rappukäytävät jne. sekä tilat, joiden kautta uloskäytävään kuljetaan.
2. Uloskäytävä, joka kattaa usein vain oven tai muun kulkutien kuten ikkunan, joka johtaa rakennuksesta ulos. Uloskäytäviksi lasketaan kuuluvaksi myös paloeristetyt porraskäytävät ja ulkona olevat portaat.
3. Kulku uloskäytävältä kokoontumisalueelle tms. turvalliselle alueelle, joka on rakennuksen ulkopuolella riittävällä etäisyydellä rakennuksen vaikutuksilta. (Cote ym. 2003, 4–65; Schroll 2002, 56–57)

Uloskäytävien **lukumäärä** tulee noudattaa rakennuksessa olevien henkilöiden määrää. Ovista voi kulkea vain tietty määrä henkilöitä tietyssä ajassa. Koska hätätilanteessa rakennuksesta on päästävä poistumaan nopeasti, on tärkeää, että uloskäytäviä on riittävästi. (Schroll 2002, 57) Tavallisesti rakennuksissa uloskäytäviä on oltava vähintään kaksi riippumatta henkilömäärästä (Cote ym. 2003, 2–23; Schroll 2002, 57). Nämä uloskäytävät tulisi sijoittaa mahdollisimman kauaksi toisistaan, jotta tulipalo ei nopeasti ja yhtäaikaisesti estä pääsyä kummallekin uloskäytävälle (ks. kuvio 1) (Schroll 2002, 57).



Kuvio 1. Uloskäytävien sijoittelu (Schroll 2002, 57).

Henkilömäärän lisäksi uloskäytävien lukumäärään vaikuttaa uloskäytävien **koko** ja **etäisyys** poistumispisteelle (Cote ym. 2003, 2–23; Schroll 2002, 57). Isommista ovista useampi ihminen pääsee kulkemaan nopeammin. Toisaalta poistuttavasta tilasta riippuen laskennallinen poistumisaika voi vaihdella, jolloin ovien koko myös vaihtelee. (Schroll 2002, 57) Esimerkiksi voimalaitoksessa, jossa on paljon

helposti syttyviä aineita, on pystyttävä poistumaan nopeammin kuin tavallisesta toimistorakennuksesta, jolloin näiden kahden tilan henkilömäärän ja ovien lukumäärän ollessa sama, voimalaitoksen ovet ovat todennäköisesti suuremmat.

Etäisyys lähimmälle uloskäytävälle vaikuttaa luonnollisesti poistumiseen kuluvaan aikaan. Etäisyys tulee laskea todellisen kulkureitin mukaan, ottaen huomioon kaikki mahdolliset esteet reitin varrella. Rakennuksen mistä tahansa pisteestä tulisi pystyä poistumaan riittävän nopeasti. Siksi isoissa rakennuksissa tarvitaan enemmän poistumisteitä kuin pienissä rakennuksissa henkilömäärän ollessa sama. (Schroll 2002, 57–58.)

Kulku uloskäytäville tulisi olla **selkeä ja esteetön**. Hätäpoistumiseen tarkoitetut ovet eivät saa olla lukittuina, kun rakennuksessa on ihmisiä. Mikäli vapaa kulku rakennukseen tai tilaan ulkoa pitää estää lukitsemalla ovi, tulee sen avaamiseen sisältä päin, poistumiskulkusuuntaan, olla lukituksen hätäavausmahdollisuus. (Schroll 2002, 58.) Kulkureitit tulee **suojata** tulelta ja savulta, jotta tuli ei pääse helposti leviämään näihin (Cote ym. 2003, 2–23).

Poistumistiet tulee **merkitä** näkyvästi, jotta kaikille rakennuksessa oleville käy selväksi, mitkä poistumisteiltä vaikuttavat poistumispisteet johtavat ulos rakennuksesta. Rakennuksissa, joita käytetään myös pimeän aikaan tai joihin ei pääse päivänvalo, tulisi poistumistiet merkitä valaistuin kyltein. (Cote ym. 2003, 2–23; Schroll 2002, 60) **Hätävalaistusta** tarvitaan, jotta poistumistiet ovat valaistuina myös sähkökatkoksen aikaan. Hätävalaistuksen tulee toimia akkuvirralla tai paristoin riittävän kauan, jotta ihmiset ehtivät poistumaan rakennuksesta. (Schroll 2002, 61)

2.4 Suomen rakentamismääräyskokoelma

Maankäyttö- ja rakennuslaissa annetut määräykset antavat yleiset edellytykset rakentamiselle sekä määrittelevät olennaisia teknisiä osia koskevat säännöt. Lisäksi maankäyttö- ja rakennuslaissa määrätään virannomaisvalvonnasta ja rakennusten lupakäsittelystä. (Suomen rakentamismääräyskokoelma 2015) Suomen rakentamismääräyskokoelmassa (RakMK) annetaan tarkempia ohjeita

rakentamiseen liittyen. RakMK:n mukaiset ohjeet ovat velvoittavia. (Rakentamismääräykset 2014; Suomen rakentamismääräyskokoelma 2015)

RakMK on koskenut ensisijaisesti uusia rakennuksia. Korjaus- ja muutostöitä määräykset ovat koskeneet vain työn laajuuden tai laadun niin edellyttäessä. Myös rakennuksen käyttötapa tai käyttötavan muutos voi edellyttää RakMK:n määräyksiä noudatettavan. RakMK:n uudistuessa ilmoitetaan, koskeeko määräys uudisrakentamista vai korjaus- ja muutostöitä. (Suomen rakentamismääräyskokoelma 2015.)

RakMK:n soveltaminen on tarkoitettu joustavaksi. Joustolla halutaan huomioda rakennuksen erityispiirteet ja ominaisuudet. Rakennustuotteiden tulee olla CE-merkittyjä. Vaihtoehtoisesti valmistaja voi halutessaan osoittaa tuotteen kelpoisuuden tyyppihyväksynnällä, varmennustodistuksella tai valmistuksen laadunvalvonnalla. (Suomen rakentamismääräyskokoelma 2015.)

2.5 National Fire Protection Association

National Fire Protection Association on vuonna 1896 New Yorkissa, Yhdysvalloissa perustettu voittoa tavoittelematon järjestö (Grant 1996; NFPA Overview 2014). NFPA ylläpitää koodeja ja standardeja, joiden tavoitteena on vähentää tulipaloista aiheutuvia tuhoja ja henkilövahinkoja. Lisäksi NFPA tekee tutkimustyötä sekä tarjoa koulutusta aiheeseen liittyen. NFPA:lla on yli 70 000 jäsentä lähes sadasta eri valtiosta. (NFPA Overview 2014)

NFPA:n mukaisia tulipalovaaraa ja tulipaloista aiheutuvia tuhoja vähentämään laadittuja koodeja ja standardeja on 300. Ne määrittelevät rakentamista, prosesseja, suunnittelua, huoltoa ja asennusta koskevia kriteerejä. Koodien ja standardien laadintaan ja päivitykseen NFPA:ssa on runsaat 200 komiteaa, joissa vaikuttaa yli 6 000 vapaaehtoista. Näissä komiteoissa äänestetään ehdotuksista ja päivityksistä *American National Standards Institution*:in (ANSI) valtuuksien myöntämän käytännön mukaan. NFPA:n koodeja ja standardeja noudatetaan Yhdysvaltojen lisäksi monessa muussa eri valtiossa. (NFPA Overview 2014.)

NFPA pyrkii myös kansainvälisellä tasolla edistämään tietoisuutta paloturvallisuudesta. Sen toimistoverkosto kattaa Aasian ja Tyynenmeren alueen, Euroopan sekä Keski- ja Etelä-Amerikan. Kansainväliset toimet keskittyvät kehittämään ja lisäämään tietoisuutta NFPA:sta, sen tehtävästä ja asiantuntemuksesta. Tiedon jakamisen ja koulutusten järjestämisen lisäksi NFPA tekee yhteistyötä hallitusten ja teollisuuden virkamiehien kanssa tavoitteenaan NFPA:n mukaisten koodien ja standardien soveltaminen näillä alueilla. NFPA osallistuu seminaareihin ja muihin tilaisuuksiin lisätäkseen maailmanlaajuista palo-, rakennus- ja henkilöturvallisuutta. (International 2013.)

3 TUTKIMUSMENTELMÄ

Vertailuun valittiin Suomen rakentamismääräyskokoelmasta *E1 Rakennusten paloturvallisuus 2011* kappale *10 Poistuminen palon sattuessa*. National Fire Protection Association koodeista vertailussa käytettiin *101 Life safety code 2015* ja *101B Code for Means of Egress for Buildings and Structures 2002*. Koska vertailu tehtiin englannin kielellä, käytettiin käännökseen epävirrallista englanninkielistä versiota RakMK:n E1 määräyksistä ja ohjeista, *E1 Fire safety of buildings 2002*. Nämä määräykset ovat kuitenkin eri vuosilta (suomenkielinen v. 2011 ja englanninkielinen käännös v. 2002), ja määräyksissä oli joitakin eroja. Siltä osin kuin määräykset erosivat toisistaan, käytettiin suomenkielistä, uudempaa versiota. Nämä kohdat on vapaasti käännetty vertailuun, ja merkitty tähdellä (*). On huomioitava, että RakMK:n käännös ja NFPA:n sanasto ei välttämättä ole yhtenevää.

NFPA:n koodeista ensisijaisesti käytettiin 101B kappaletta 5 *New Construction*, koska siinä käsitellään vain uusia rakennuksia koskevat määräykset. Siihen on koottu eri rakennustyyppejä koskevat määräykset samaan paikkaan. Lisäksi määräykset on kirjoitettu niin, että ne on hieman helpompi ymmärtää verrattuna NFPA-koodin 101 kappaleeseen 7 *Means of Egress*. Muutoin NFPA-koodin 101 kappaleessa 7 käsitellään lähes samat asiat kuin koodin 101B kappaleessa 5, mutta koodin 101 kappale 7 käsittelee sekä uusia että olemassa olevia rakennuksia. Lisäksi tässä kappaleessa jää avoimeksi kaikki teollisuusrakennuksia koskevat erityismääräykset. Nämä on käsitelty erikseen kappaleessa 40 *Industrial Occupancies*. Joiltakin osin koodin 101 kappaleessa 7 on kuitenkin käsitelty asioita, joita ei koodin 101B kappaleessa 5 ole lainkaan mainittu. Nämä tiedot on lisätty taulukkoon. Kaikki tiedot koodin 101B kappaleen 5 ja koodin 101 kappaleiden 7 ja 40 välillä eivät myöskään täsmää keskenään. Näissä tapauksissa on käytetty kappaleita 7 ja 40 koodista 101, koska se on uudempi (v. 2015) kuin koodi 101B (v. 2002).

3.1 Vertailun jaottelu

Vertailu tehtiin taulukkomuodossa taulukkolaskentaohjelmalla. Ensiksi tehtiin taulukko, johon yhdistettiin NFPA-koodien 101 kappaleen 7 ja kappaleen 40 sekä 101B kappaleen 5 määräykset. Tämä taulukko on liitteenä 1b. Tämä taulukko noudattaa NFPA-koodien mukaista jaottelua. Seuraavaksi tehtiin vastaava taulukko RakMK:n määräyksistä. Taulukko tehtiin ensiksi alkuperäiskielellä eli suomeksi. Sen jälkeen lisättiin vastaava englanninkielinen käännös. Tämä taulukko vastaavasti noudattaa RakMK:n mukaista jaottelua, mutta joiltakin osin määräyksiä on jaettu eri riveille, koska vertailua varten määräyksiä on jaettu eri aihepiireihin, ja tällöin seuranta on helpompaa. Tämä taulukko on liitteenä 1a.

NFPA:a ja RakMK:a erikseen käsittelevät liitteet auttavat hahmottamaan kokonaisuutta ko. määräyksen mukaisen jaon mukaan. Jos esimerksi haluaa katsoa ovia koskevia määräyksiä kokonaisuutena, voi tämän helposti nähdä NFPA:a käsittelevästä liitteestä 1b. Jotta RakMK:n ja NFPA:n määräyksiä voisi verrata ristiin vertailutaulukon kanssa, on näitä määräyksiä erikseen käsitteleviin taulukoihin merkattu mihin aihepiiriin ko. määräys on lisätty.

Samalla kun edellä mainittuja taulukkoja tehtiin, jätettiin niistä pois määräykset ja ohjeet, jotka eivät koske diesel- ja kaasuvoimalaitosten moottorihallia. Nämä poisrajaukset on esitetty kappaleessa *3.2 Rajaukset*. Rajaukset kirjattiin myös erilliselle välilehdelle vertailu-tiedostoon, jotta se on helposti saatavilla vertailutaulukon käyttäjälle. Tämä välilehti on liitteenä 1c. Rajausten lisäksi toisessa liitteessä on annettu määritelmiä osaan sekä NFPA:ssa että RakMK:ssa käytettyihin käsitteisiin tai lyhenteisiin. Nämä ovat liitteessä 1d.

Vertailua varten määräykset jaettiin eri aihepiireihin, esitettyyn teoriaan nojautuen. Nämä aihepiirit ovat yleistä (*0. General*), uloskäytävien lukumäärä (*1. Number of exits*), uloskäytävien koko (*2. Size of exits*), poistumisetäisyys (*3. Travel distance to exit*), pääsy uloskäytäville (*4. Access to exit*), uloskäytävien suojaaminen (*5. Separation of exits*), poistumisteiden merkitseminen (*6. Exit marking*) sekä poistumisteiden valaistus (*7. Exit illumination*). Tämän lisäksi on ala-aihepiirejä, kahdessa tasossa. Esimerkiksi ”uloskäytävien koko” -aihepiirin

alla on ala-aihepiiri ”vähimmäismitat”, jonka alla on vielä ala-aihepiirit ”ovet”, ”portaat”, ”rampit” jne.

Määräykset jaettiin parhaan näkemyksen mukaan eri aihepiirien alle. Yleisiin määräyksiin laitettiin määräyksiä, jotka ovat yleispäteviä, tai jotka koskettivat joko useampaa tai ei mitään muista aihepiireistä. Uloskäyntien lukumäärä käsittelee, paitsi nimenomaan kuinka monta uloskäyntiä rakennuksessa tulee olla, myös miten uloskäynnit tulee sijoittaa sekä mitä voidaan laskea uloskäynniksi ja mitä ei (t.s. varauloskäynnit). Uloskäyntien koko määrittelee ensisijaisesti uloskäyntien leveyttä, leveyden laskemista sekä mittaamista. Lisäksi annetaan määritelmiä muista uloskäyntien kokoon liittyvistä asioista, kuten porrasten leveydestä ja kattokorkeudesta. Poistumisetäisyys määrittää, kuinka poistumisetäisyys lasketaan, ja mitkä ovat enimmäispoistumismatkat mistä tahansa rakennuksen osasta turvalliseen kokoontumispaikkaan. Pääsy uloskäynnille käsittelee asioita, jotka liittyvät siihen, kuinka helppoa on päästä rakennuksesta ulos. Esimerkiksi tässä osassa käydään läpi kynnysten kokoa, lattian pintaa, poistumisteillä olevia esteitä jne. koskevia määräyksiä. Uloskäytävien suojaus koskee rakenteiden palokestävyyttä ja savunpoistoa. Poistumisteiden merkitseminen käsittelee, miten eri uloskäytävät ja poistumistiet tulee merkitä, ja poistumisteiden valaistus vastaavasti, miten poistumistiet tulee valaista.

Joissakin tapauksissa jaon voisi perustellusti tehdä myös toisin. Esimerkiksi uloskäyntien sijoittelun olisi voinut laittaa joko uloskäyntien lukumääriä käsitelevän aihepiirin alle, uloskäytävien etäisyyttä käsittelevän aihepiirin alle tai ulospääsyä käsittelevän aihepiirin alle. Ulospääsy on mahdotonta, mikäli uloskäynti on tulen takana. Tästä syystä sijoittelu voisi liittyä ulospääsyn helppouteen. Toisaalta uloskäytävän tulee olla tietyllä etäisyydellä jokaisesta rakennuksen osasta, jolloin sijoittelu liittyy etäisyyksiin. Uloskäyntien sijoittelu on kytköksissä uloskäyntien lukumäärän kanssa, koska kahta uloskäyntiä ei ole järkevä laittaa vierekkäin. Lisäksi NFPA:ssa uloskäyntien sijoittelu on käsitelty uloskäyntien lukumäärän kanssa samassa osassa. Näiden kahden syyn perusteella

uloskäytävien sijoittelu laitettiin uloskäytävien lukumäärää käsittelevän aihepiirin alle.

Vertailu-taulukkoon on merkattu aihepiirin numero sekä aihepiirin ja ala-aihepiirien nimet. Ensimmäisen tason ala-aihepiirin erottaa pääaihepiiristä sillä, että sen edessä ei ole aihepiirin numeroa ja ala-aihepiiri on hieman sisennetty. Toisen tason ala-aihepiiristä ensimmäisen tason ala-aihepiirin erottaa mustennuksesta – toisen tason ala-aihepiiriä ei ole mustennettu. Aihepiirien jälkeen tulee ensin RakMK:n mukaiset määräykset ja sen jälkeen NFPA:n mukaiset määräykset. Kummastakin on ensin merkitty määräyskokoelma (RakMK) tai koodi (NFPA), sen jälkeen pykälä ja viimein määräysteksti. Vertailu on liitteenä 1e.

3.2 Rajaukset

Vertailuun käytettiin ainoastaan aikaisemmin mainittuja määräyksiä ja standardeja. Siltä osin kuin näissä viitattiin NFPA-koodien 101 ja 101B tai RakMK E1:n sisäisiin kappaleisiin ja pykäliin, on nämä huomioitu vertailussa ja lisätty erillisinä liitteinä vertailuun. Nämä ovat liitteissä 1f-h. Kaikki viittaukset muihin kuin edellä mainittuihin koodeihin ja määräyksiin on mainittu, mutta ei lisätty tuloksiin eikä liitteisiin.

Vertailussa on huomioitu ainoastaan uusia rakennuksia koskevat määräykset. Rakennusten kerrosluku on rajattu kolmikerroksisiin rakennuksiin. Diesel- ja kaasumoottorivoimalaitoksissa ei yleensä ole kuin kaksi kerrosta, mutta rakenteen korkeudesta johtuen esimerkiksi moottorihallin yhteyteen rakennetut tilat voivat olla kolmikerroksisia.

Vaikka voimalaitoksissa on pääsy katolle, ja katolla voi olla voimalaitokseen liittyviä laitteita, vertailussa on huomioitu ainoastaan, kuinka poistuminen katolta tulee järjestää, mutta poistumistien johtuminen katolle on jätetty huomiotta. Samoin vertailusta on jätetty pois kaikki muut poistumisalueet kuin poistuminen ulos rakennuksen ulkopuolelle. Näin ollen erilaiset rakennuksia yhdistävät käytävät ja mahdolliset rakennuksen sisäiset poistumisalueet on jätetty huomiotta.

Poistumisteinä ei pidetä hissejä tai liukuportaita. Liukuportaita ei yleensä voimalaitoksissa ole, ja hissejäkin harvemmin. Rakennus on kuitenkin niin matala, että hissiä ei tarvitse poistumiseen käyttää (vrt. pilvenpiirtäjät). Portaat on rajattu tavallisiin suoriin portaisiin, kierreportaisiin ja ulkona oleviin portaisiin. Kaikki muut portaat ja kerrosten väliset poistumismahdollisuudet on rajattu pois.

Maanalaiset rakennukset sekä tornit on rajattu pois. Voimalaitoksissa vältellään kellarikerroksia, koska moottorit halutaan yleensä maan tasalle niiden painosta johtuen. Niille tehtävä perusta on hyvin paksu, joten kerrosten rakentaminen moottorihallin alle ei ole taloudellista. Torneja ei laitoksissa tarvita. Lisäksi rakennuksen jakamista savuseinin ei ole huomioitu. Mikäli savuseiniä rakennetaan, täytyy jokainen jaettu alue laskea omaksi poistumisalueekseen vertailua hyväksikäytettäessä.

Viimein, henkilömäärän ei katsota koskaan ylittävän 500:aa. Voimalaitoksissa päivittäin työskentelevien henkilöiden määrä riippuu hieman voimalaitoksen koosta. Kuitenkaan isossakaan voimalaitoksessa ei olle yli sataa henkilöä, vaikka osa moottoreista olisi huollossa, ja siten paikalla olisi tavallista enemmän huoltohenkilökuntaa.

4 TULOKSET

Tässä luvussa käsitellään vertailun tuloksia samassa järjestyksessä kuin ne ovat vertailutaulukkoon kirjattu. Tuloksia ei käydä läpi yksityiskohtaisesti, vaan painopiste on Suomen rakentamismääräyskokoelman ja National Fire Protection Associationin yhtäläisyyksissä ja eroissa yleisellä tasolla ja eritoten tuotantolaitoksia koskevissa määräyksissä. Tarkat määräykset on kirjattu liitteeseen 1e.

Tuloksia luettaessa on hyvä huomioida, että RakMK:n mukaisten paloluokkien mukaan diesel- ja kaasuvoimalaitoksen moottorihalli on P2- tai P1-luokkaa. P2-luokka koskee kuitenkin korkeintaan yksikerroksisia moottorihalleja, koska kaksikerroksisena rakennuksen korkeus ylittää P2-luokalle sallitun maksimi korkeuden, 9 m. NFPA:ssa jaotellaan rakennuksia tai sen osia vähäisen, normaalin ja korkean riskitason tiloihin. Käytännössä tila, jossa moottorit ovat ja tilat, joissa varastoidaan polttoaineita, ovat korkean riskitason tiloja polttoaineiden helposta syttyvyydestä johtuen. Moottorihallin yhteydessä olevat muut tilat voivat olla joko normaalin tai vähäisen riskitason tiloja.

4.1 Yleistä

Sekä RakMK:n että NFPA:n mukaan uloskäytävän tulee johtaa ulos rakennuksesta. RakMK:n mukaan vaihtoehtoisesti uloskäytävä voi johtaa muuhun turvalliseen paikkaan. NFPA ei anna samanlaista mahdollisuutta, mutta määrittelee erityistapauksen, jolloin uloskäytävä voi johtaa tilaan, jonka läpi voidaan kulkea ulos. Niin kauan, kun uloskäytävät johtavat ulos, voidaan kuitenkin olla varmoja, että täytetään kummatkin määräykset.

Kummassakin määräyksessä annetaan myös määritelmät tilanteille, joissa määräyksistä voidaan yleisesti poiketa. RakMK:ssa määräyksistä voidaan poiketa, mikäli uloskäytävää on tarkoitettu käytettävän ainoastaan palotilanteissa ja henkilömäärä on pieni. NFPA sitä vastoin määrittelee hyötykäyttötilat, joihin on sijoitettu ainoastaan sähköisiä-, mekaanisia- ja viemäröintilaitteita, ja joihin pääsy

on rajoitettu, sellaisiksi tiloiksi, joihin määräyksiä ei tarvitse soveltaa. RakMK:ssa on myös mainittu poistumisaikalaskelman vaatimisen mahdollisuus. NFPA:ssa ei tätä mainita.

4.2 Uloskäytävien lukumäärä

Sekä RakMK:n että NFPA:n mukaan uloskäytäviä pitää yleisesti olla kaksi kappaletta. Kummassakin mainitaan kuitenkin poikkeustapauksia, joiden mukaan yksi uloskäytävä voidaan hyväksyä. Näiden poikkeusten määritelmät eivät ole samanlaisia, joten pääsääntöisesti vain rakennukset, joissa on vähintään kaksi uloskäytävää täyttävät kummatkin määräykset.

RakMK hyväksyy yhden uloskäytävän tuotantotiloista, jotka ovat alle kahdeksankerroksisia, ja joiden huoneala on alle 300 m². Tällöin tilassa tulee olla uloskäytävän lisäksi yksi varatie, jonka kautta voidaan poistua joko omin avuin tai palolaitoksen avulla. Muita sääntöjä tai poikkeuksia uloskäytävien lukumäärästä ei RakMK:ssa anneta.

NFPA:n mukaan tuotantotiloista, joissa on alhainen tai normaali riskitaso, voidaan hyväksyä vain yksi uloskäytävä, mikäli etäisyys uloskäytävään ja ulos rakennuksesta on korkeintaan 15 m tai 30 m, mikäli rakennuksessa käytetään hyväksyttyä sprinklerijärjestelmää. Korkean riskitason poistumisalueilta vaaditaan aina kaksi uloskäytävää, mikäli tila on isompi kuin 18,6 m², siellä oleskelee enemmän kuin kolme henkilöä tai etäisyys ovelta ulos turvaan on enemmän kuin 7620 mm.

RakMK:n mukaan varauloskäytäväksi voidaan laskea parveke tai ikkuna, josta voi poistua maan tasalle joko kiinteitä tikkaita pitkin, rakennusosia apuna käyttäen tai pelastustoimenpitein. Kaksikerroksisissa P2- ja P3-luokan rakennuksissa parvekkeelta tai ikkunasta tulee olla kiinteät tikkaat maan pinnalle tai muuhun turvalliseen paikkaan, mutta pudotuskorkeuden ollessa korkeintaan 3,5 m kiinteitä tikkaita ei tarvita. Varauloskäyntinä käytetyn ikkunan korkeuden tulee olla vähintään 600 mm ja leveyden vähintään 500 mm. Lisäksi leveyden ja korkeuden summan tulee olla vähintään 1500 mm. Eli esimerkiksi ikkunan, joka täyttää

vähimmäisleveyden 500 mm, tulee olla vähintään 1000 mm korkea. Hissiä ei lasketa uloskäynniksi.

Myös NFPA sallii parvekkeiden ja sen tapaisten käytön varauloskäyntinä. Parvekkeen pitkän sivun tulee tällöin olla vähintään 50 %:sti avoin. Mikäli parvekkeelta ei ole kulkua vähintään kaksille rakennuksesta etäällä oleville portaille, tulee se suojata rakennuksen sisäosilta käytävien palosuojausta vastaavin seinin ja ovi- ja ikkuna-aukoin. Tästä voidaan poiketa, mikäli poistumistiellä ei ole 6100 mm pidempää umpikujaa. Tikkaat sallitaan poistumistienä vain a) katoilta, joissa ei oleskella, b) laitteiston huoltotasanteilta, joissa oleskelee korkeintaan kolme henkilöä tai c) kattilahuoneista toissijaisena kulkureittinä. Tikkaiden kaltevuus saa olla korkeintaan 75 % ja alimman riman korkeus tasosta korkeintaan 305 mm. Paloportaita ei tule laskea uloskäytäväksi.

RakMK määrittää uloskäytävien sijainnin käytännössä vain mainitsemalla, että niiden tulee olla sopivasti sijoitettuja. Lisäksi huomautetaan, että matka uloskäytäville ei tule olla liian pitkä, jotta poistumiseen ei kulu vaarallisen paljon aikaa. Uloskäytävistä on myös voitava kuljettaa liikuntakyvytön henkilö paareilla.

NFPA:ssa määrätään uloskäytävät sijoitettavaksi mahdollisimman kauaksi toisistaan ja niin, että palon sattuessa useampi uloskäytävä ei jää palon tai muun esteen taakse. Uloskäytävien tulee olla helposti lähestyttäviä kaikkina aikoina. Kun vaaditaan kaksi uloskäytävää, tulee ne sijoittaa toisistaan etäisyydelle, joka on vähintään puolet rakennuksen diagonaalin pituudesta. Mikäli uloskäytäviä vaaditaan enemmän kuin kaksi, tulee vähintään kahden uloskäytävän täyttää tämä vaatimus. Uloskäytävät tulee järjestää niin, ettei käytävissä ole umpikujia. Poikkeuksena ovat tuotantotilat, joissa ei ole korkea riskitaso. Näissä korkeintaan 15 m käytävät tai 30 m käytävät, joissa on sprinklerijärjestelmä, voivat päättyä umpikujaan. Poistuminen ei saa tapahtua keittiöiden, varastojen, vaatehuoneiden, kylpyhuoneiden tms. tilojen läpi, jotka mahdollisesti ovat lukittavissa. Uloskäytävien oviin tai niiden läheisyyteen ei saa laittaa peilejä, jotka voivat hämätä todellista kulkusuuntaa. Myös NFPA:n mukaan uloskäytävät tulee järjestää niin, että niitä pitkin voidaan kuljettaa liikuntakyvytön henkilö.

Uloskäytävien lukumäärä on siis käytännössä RakMK:ssa ja NFPA:ssa sama. Eroja määräyksissä esiintyy lähinnä varauloskäyntien määritelmissä. Vaikka RakMK:ssa ei kovin tarkasti eritelty uloskäytävien sijaintia, voidaan olettaa, että RakMK ja NFPA ovat tässäkin asiassa samalla linjalla.

4.3 Uloskäytävien koko

Sekä RakMK:n että NFPA:n mukaan uloskäytävien vähimmäisleveys lasketaan henkilömäärän mukaan. Mikäli enimmäishenkilömäärä ei ole tiedossa, arvioidaan henkilömäärä kummassakin pinta-alan mukaan. Määritellyt pinta-alat per henkilö eivät kuitenkaan ole näiden määräysten mukaan samat. RakMK:n mukaan teollisuusrakennuksissa lasketaan 30 m² yhtä henkilöä kohden. NFPA:ssa vastaava luku on vain 9,3 m². Tämä koskee myös korkean riskitason alueita, mutta erityistapauksissa, joissa tuotantotila on käytännössä miehittämätön, lasketaan henkilömäärä sen mukaan, mikä on tilan mahdollinen enimmäishenkilömäärä.

RakMK:n mukaan uloskäytävien yhteenlaskettu leveys tulee olla vähintään 1200 mm ensimmäisen 120 henkilön osalta, jonka jälkeen määrää kasvatetaan aina 400 mm jokaista seuraavaa 60 henkilöä kohden. Uloskäytäviin johtavien käytävien vähimmäisleveys on sama kuin uloskäytävien vähimmäisleveys. Mikäli useampi kerros, jotka muodostavat erilliset palo-osastot, kulkevat saman uloskäytävän kautta, tulee uloskäytävän vastata kerroksien yhteenlaskettua henkilömäärää.

NFPA:n mukaan teollisuustiloissa, joissa on korkea riskitaso, tulee uloskäytävän portaiden leveyden olla 18 mm kerrottuna henkilömäärällä. Muut uloskäytävien osat tulee olla 10 mm kerrottuna henkilömäärällä. Muissa teollisuustiloissa kuin korkean riskitason tiloissa vastaavat vähimmäisleveydet ovat 7,6 mm kerrottuna henkilömäärällä ja 5 mm kerrottuna henkilömäärällä. Mikäli kerroksen alla ja yllä olevat kerrokset yhtyvät yhdeksi uloskäytäväksi, tulee uloskäytävän leveys mitoittaa yhteenlasketun henkilömäärän mukaan.

RakMK:n mukaan uloskäytävän vähimmäisleveyden tulee olla vähintään 1200 mm, mutta korkeintaan 60 henkilön tiloissa toinen uloskäytävä voi olla 900 mm leveä. Uloskäytävien vähimmäiskattokorkeus on 2100 mm. Tämän korkeuden alla

ei tule olla palkkeja, putkia tai lamppuja. NFPA:n mukaan vähimmäisleveys on 915 mm, eli huomattavasti kapeampi kuin RakMK:n mukainen vähimmäisleveys. NFPA:ssa mainitaan vielä joitakin poikkeuksia, joissa tätä vähimmäisleveyttä ei tarvitse noudattaa, kuten teollisten laitteiden huoltotilojen käytävät ja portaat, joiden henkilömäärä ei ylitä 20:ta. Näissä vähimmäisleveys on 560 mm. Vähimmäiskattokorkeus NFPA:ssa on 2285 mm, mutta joiltakin osin kattokorkeuden sallitaan laskevan 2030 mm:iin. 2030 mm on myös portaikon vähimmäiskattokorkeus.

NFPA:ssa annetaan lisäksi rajoitukset yksittäisille uloskäytävien osuuksille. Ovien vähimmäisleveys on 810 mm sekä portaiden ja ramppien vähimmäisleveys on 915 mm, kun henkilömäärä on alle 50 ja 1120 mm, kun henkilömäärä on yli 50 mutta alle 2000. Porrasaskelman suurin sallittu korkeus on 180 mm ja pienin sallittu korkeus 100 mm. Portaan vähimmäissyvyys on 280 mm. Käänteissä askelman syvyys tulee saavuttaa 305 mm päässä portaan kapeammasta reunasta. Käänteiden säteen tulee olla ainakin kaksi kertaa portaan leveys. Kierreportaissa askelman vähimmäissyvyys tulee saavuttaa poistumisleveyden mukaisella alueella. Kun henkilömäärä ei ylitä kolmea, kierreportaille annetuille säännöille on annettu poikkeavat rajat. Esimerkiksi askelmakorkeus voi olla jopa 240 mm. Ramppien enimmäiskaltevuus on 1:12, ja yksi ramppi saa nousta korkeintaan 760 mm. Tasanteiden välinen matka sekä portaissa että rampeissa saa olla korkeintaan 3660 mm.

Vähimmäisleveys mitataan sekä RakMK:n että NFPA:n mukaan poikittain uloskäytävän kulkusuunnassa. NFPA:ss huomautetaan vielä, että leveys tulee mitata kapeimmasta kohdasta. RakMK sallii jalkalistat, reunapalkit ja käsijohteet vähimmäisleveyden sisälle. NFPA sallii korkeintaan 90 mm sisennyksen uloskäytävän kumminkin puolin korkeintaan 965 mm korkeudella. Ovien leveyden mittauksessa on RakMK:sa ja NFPA:ssa isompia eroja. RakMK:n mukaan oven leveyteen voidaan mitata ovien karmit, eli ovien kulkuaukon vähimmäisleveydestä voidaan vähentää ovien karmeihin käytetty leveys. NFPA:n mukaan tätä vähennystä ei voi tehdä. Lisäksi NFPA:n mukaan oven kulkuleveys mitataan kun ovi on avattu 90° kulmaan, eli käytännössä aukko kapenee myös

ovilehden paksuuden verran. Vähintään 865 mm ja korkeintaan 1220 mm korkeudella olevat, korkeintaan 100 mm leveät projektiot, kuten ovenkahvat, ovat sallittuja. Samoin kaikki yli 2030 mm korkeudella olevat esteet ovat sallittuja. Porrasaskelmien syvyys mitataan askelmien kärkien etäisyyden mukaan eikä siihen lasketa reunojen pyöristyksiä tai vinoleikkauksia.

Uloskäytävien vähimmäisleveydet RakMK:ssa ovat siis leveämmät kuin NFPA:ssa. RakMK:ssa annetaan lisäksi vain yksi leveys, joka koskee kaikkia uloskäytävien osia, mutta NFPA:ssa määritellään oville, käytäville, portaille ja rampeille omat vähimmäisleveydet. NFPA:n mukainen vähimmäisleveyden laskentakaava on yksityiskohtaisempi kuin RakMK:n, ja ottaa huomioon tarkan henkilömäärän. RakMK:ssa leveys hyppää 60 henkilön ryhmissä. Kummassakin tapauksessa leveys mitataan lähes samalla tavalla, vaikka NFPA:ssa leveyden mittaaminen on määritelty tarkemmin. Vähimmäiskattokorkeus on määräyksissä eri, ja RakMK:ssa ehdottomampi. Lisäksi NFPA:ssa määritellään myös muita mittoja kuin uloskäytävien leveys ja korkeus, kun RakMK:ssa nämä ovat ainoat annetut mitat.

4.4 Poistumisetäisyydet

RakMK:n mukaan etäisyys uloskäytävään mitataan lyhyintä mahdollista reittiä pitkin. Mikäli reitti ei ole etukäteen tiedossa, mitataan reitti seinien viertä pitkin. Siltä osin kuin kaksi poistumisreittiä yhtyy, mitataan tämä osuus kaksinkertaisena. NFPA:n mukaan etäisyys uloskäytävään mitataan luonnollisen kulkureitin keskeltä kauimmaisesta pisteestä alkaen ulko-oven keskelle. Kulmat kierretään pyöristäen 305 mm sisäreunoista. Portaat ja rampit, joita pitkin tulee kulkea uloskäytävään, lasketaan osaksi kuljettavaa matkaa. Portaiden matka mitataan porrasaskelman etureunasta. Mikäli uloskäytävä johtaa ulkopuolisiin portaisiin, jotka ovat lähempänä kuin 3050 mm päässä suojaamattomasta rakennusaukosta, tulee myös näitä portaita pitkin kuljettu matka maan tasalle laskea osaksi poistumisetäisyyttä.

RakMK:ssa pisin sallittu etäisyys uloskäytävään tuotantotiloissa on yleisesti 45 m, mutta ainoastaan 30 m, jos rakennuksessa on vain yksi uloskäytävä. Tästä

poiketen etäisyydet voidaan ylittää, mikäli tilasta on mahdollista poistua maan tasalle avattavasta ikkunasta tai mikäli rakennuksessa on automaattinen sammutusjärjestelmä. Toisaalta lyhyempiä etäisyyksiä voidaan vaatia, mikäli on syytä epäillä, että palo syttyy ja leviää nopeasti. NFPA:n sallima etäisyys uloskäytävään tuotantotiloissa on 61 m tai 76 m tiloissa, joissa on käytössä hyväksytty sprinklerijärjestelmä. Tuotantotilat, joissa ei tavallisesti oleskele ihmisiä, sallitaan jopa 122 m etäisyys, mikäli käytössä on hyväksytty sprinklerijärjestelmä, tai 91 m, mikäli sprinklerijärjestelmää ei ole. Tiloissa, joissa on korkea riskitaso, vaaditaan kuitenkin aina sprinklerijärjestelmä, ja etäisyys saa olla korkeintaan 23 m. Kattilahuoneistossa etäisyys on rajattu 15 m:iin, mikäli käytössä ei ole sprinklerijärjestelmää, mutta 30 m:iin, mikäli sprinklerijärjestelmä on käytössä.

RakMK:ssa sallittu etäisyys uloskäytävään on lyhyempi kuin NFPA:ssa. Etäisyys mitataan hieman eritavoin eri määräysten mukaan. Epäselvissä tapauksissa RakMK:n määritelmä etäisyyden mittausreitistä on selkeämpi. NFPA:ssa annetaan vaihtoehtoinen, pidempi etäisyysvaatimus, mikäli käytössä on hyväksytty sprinklerijärjestelmä. RakMK ei tälläistä eroa tee.

4.5 Pääsy uloskäytävään

Sekä RakMK:n että NFPA:n mukaan ovien tulee avautua uloskäytävissä poistumiskulkusuuntaan. RakMK:ssa vaaditaan ulos johtavien ja uloskäytävään johtavien ovien lisäksi sisäisiin käytäviin johtavien ovien aukeavan kulkusuuntaan. NFPA:n mukaan avautuessaan oven tulee jättää vähintään puolet vaaditusta käytävän tai portaan tasanteen vaaditusta leveydestä vapaaksi. Täysin avattu ovi saa viedä korkeintaan 180 mm tilaa käytävien ja tasanteiden leveydestä.

RakMK:ssa mainitaan, että ovien tulee olla helposti avattavissa. NFPA määrittelee oven avaamisen tarkemmin, antaen enimmäisvoiman, mitä ovien avaamiseen tarvitaan. Kahvan painamiseen tarvittava voima ei saa ylittää 67 N:a, oven liikkeeseen saattaminen ei saa ylittää 133 N:a ja oven täysin auki avaamiseen tarvittava voima ei saa ylittää 67 N:a. NFPA:ssa määritellään vielä

erilaisten ovien toimintaa erikseen, mutta pääsääntöisesti kaikkiin pätee yllä mainitut voimamääreet.

Sekä RakMK:ssa että NFPA:ssa kielletään sellaisten lukkojen ja salpojen käyttö, joita ei voi sisältä avata ilman avainta. NFPA:ssa vaaditaan salpaan avausjärjestelmä, jonka käyttö on selkeää ja jonka voi hätätilanteessa kunnolla avata. Kaksoisovissa kummankaan oven avaaminen ei saa olla riippuvainen toisen oven avaamisesta. Sekä RakMK:n että NFPA:n mukaan kulunvalvontajärjestelmä ovissa on sallittua, mutta ei saa estää oven vapaata käyttöä hätätilanteessa. Korkean riskitason tiloissa oviin tulee NFPA:n mukaan laittaa paniikki- tai palopoistumisvarustus.

NFPA:n mukaisten portaiden tulee olla kiinteät ja ovien kohdilla tulee olla tasanteet. Tasanteen tulisi olla pituudeltaan vähintään portaiden leveyden mukainen, mutta pituuden ei tarvitse ylittää 1220 mm:ä. Portaiden tulee olla tasaiset, eikä niissä saa olla uria tai kielekkeitä, jotka voivat aiheuttaa kaatumisen. Kahden peräjälkeisen askelman syvyys- tai korkeusero ei saa ylittää 4,8 mm:ä eikä koko portaikon askelmien syvyysero saa ylittää 9,5 mm:ä. Ulkona olevien portaiden tulee olla suunniteltu niin, että myös korkeanpaikankammoiset henkilöt voivat niitä käyttää. Askelmat tulee ulkoportaissa suunnitella niin, ettei niille kerry vettä. Näiden portaiden tulee olla vähintään 50 %:sti avoimet, jotta niihin ei kerry savua.

NFPA:ssa ramppeihin pätee samankaltaiset määräykset. Erotuksena ovat tasanteet, joiden pituuden tulee enimmillään olla 1525 mm:ä. Lisäksi ramppien kulkusuunnan vaihdokset tulisi tapahtua tasanteilla. Näiden tasanteiden vähimmäismitan tulisi olla 1525 mm x 1525 mm. Ramppien kaltevuus saa olla korkeintaan 1:48. Avoimella rampin reunalla tulisi olla vähintään 100 mm korkea reunus, joka estää rampilta suistumisen.

Mikäli poistumistie on yli 760 mm lattianpintaa tai muuta tasoa korkeammalla, tulee NFPA:n mukaan avoimelle puolelle laittaa kaide. Kaikissa portaissa ja rampeissa tulee olla käsijohteet molemmin puolin. Lisäksi portaissa tulee olla käsijohteet aina vähintään 760 mm etäisyydellä jokaisesta pisteestä portaan

leveydellä. Käsijohteiden tulee jatkua koko portaikon tai rampin syöksyn pituuden. Portaiden kääntyessä käsijohteen tulee jatkua yhtenäisenä tasanteiden sisäreunassa. Kaiteet ja käsijohteet tulee suunnitella niin, etteivät vaatteet jää niihin kiinni, ja kaiteiden päät tulee kääntää takaisin seinään tai lattiaan tai ne tulee päättää kaidepylvääseen. Käsijohteen tulee olla 865–965 mm korkeudella portaista tai rampista ja vähintään 38 mm irti seinästä. Käsijohteen pinta tulisi olla pyöreä ja sen leveys tulisi olla 32-51 mm. Kaiteen tulee olla vähintään 1065 mm:ä korkea ja 865 mm:n korkeuteen asti kaiteessa ei saa olla aukkoja, joista halkaisijaltaan vähintään 100 mm pallo pääsee läpi.

NFPA:n mukaan poistumisteiden lattiatasojen tulee olla tasaiset eikä yli 6,3 mm äkkinäistä muutosta lattianpinnassa saa tapahtua. Mikäli pinnan muutos on 6,3–13 mm tulee muutos tasoittaa suhteessa 1:2 olevalla viisteellä. Tämä koskee myös ovien kynnyksiä. Mikäli lattianpinta viettää, saa kaltevuus olla korkeintaan 1:20. Muussa tapauksessa ramppia koskevat vaatimukset tulee täyttää.

RakMK:n mukaan uloskäytävissä ei saa käyttää materiaaleja tai elementtejä, jotka kasvattavat palokuormaa. NFPA kieltää sellaisen kalustuksen ja verhoilun, joka estää kulun tai rajoittaa näkyvyyttä uloskäytävissä. Lisäksi erilaiset, huoneita jakavat portit ja kaiteet poistumisteillä ovat NFPA:ssa kiellettyjä.

Vaikka RakMK:ssa ja NFPA:ssa on samantapaisia määräyksiä, joiden tarkoitus on helpottaa rakennuksesta poistumista, on selvää, että NFPA:ssa tähän on kiinnitetty enemmän huomiota. Ovien aukeamissuunnat, avaaminen ja lukitus ovat asioita, joista kummassakin määräyksessä on mainittu. NFPA antaa kuitenkin paljon enemmän huomiota erityisesti rakennuksen korkeuseroja koskeville asioille aina lattian pienistä tasoeroista kerrosten välisiin korkeuseroihin. NFPA:ssa on myös huomioitu kaiteet ja käsijuoksut paljon tarkemmin kuin RakMK:ssa.

4.6 Uloskäytävän suojaus

Uloskäytävä on yleensä oma palo-osasto RakMK:n mukaan. Korkeintaan kahdeksankerroksisissa alle 24 m korkeissa P1-luokan rakennuksissa uloskäytävien tulee olla vähintään palo-osastoitu. Mikäli rakennus on yli 24 m

korkea, tulee uloskäytävän olla palolta suojattu. NFPA:n mukaan vaadittaessa uloskäytävät tulee suojata vähintään tunnin paloeristyksellä muusta rakennuksesta, kun uloskäytävä yhdistää korkeintaan kolme kerrosta. Lisäksi läpiviennit tulee rajoittaa välttämättömiin sähkökaapeleihin, ilmastointi- ja vesiputkiin tms.

Poistumisalueella kahden tason välillä saa RakMK:n mukaan olla portaat vain, mikäli nämä tasot katsotaan kuuluvan samaan palo-osastoon. Porrassyöksyjen tulee P1- ja P2-luokan rakennuksissa täyttää luokan R30 vaatimukset, kun palokuorma on alle 600 MJ/m² ja luokan R60 vaatimukset, kun palokuorma on tätä suurempi. Yli kaksikerroksisissa P1-luokan rakennuksissa rakennemateriaalin tulee olla vähintään A2-s1, d0 -luokkaa. Luokan K2 30, A2-s1, d0 tarvikkeet voidaan korvata EI 30, A2-s1, d0 -luokan tarvikkeilla. Koska portaisiin ja ramppeihin pätee NFPA:n mukaan yllä mainittu tunnin palosuojaus, ja koska moottorihallin palokuorma ylittää 600 MJ/m², ovat RakMK:n ja NFPA:n vaatimukset samat. Mikäli portaat eivät ole kauttaaltaan palosuojatut, kuten rakennuksen ulkopuoliset portaat, tulee seinät ja aukot, jotka ovat korkeintaan 180° kulmassa portaisiin, NFPA:n mukaan suojata 3050 mm matkalta vaakatasossa ja maasta lähtien vähintään 3050 mm portaiden ylätasanteen yläpuolelle tai katon rajaan asti tunnin palosuojauksella.

Mikäli uloskäytävä on savulta suojattu, on palosuojauksen oltava NFPA:n mukaan kaksituntinen. Savusuojatun uloskäytävän ilmastoinnille on myös annettu säännöksiä riippuen ilmastoinnin tyypistä. Nämä määrittelevät ilmastoinnin palosuojausta, ilmanvaihdon nopeutta ja uloskäytävän paineistusta. Varageneraattorin tulee huolehtia siitä, että ilmastointi toimii ainakin kahden tunnin ajan. RakMK:ssa mainitaan vain, että mikäli uloskäytävä kapenee kulkusuunnassa, tulee porraskäytävä varustaa savunpoistoluukulla tai automaattisella savunpoistolaitteistolla. NFPA:n mukaan savusuojattuun uloskäytävään johtavat ovet tulisi varustaa automaattisilla sulkijoilla. Lisäksi NFPA:ssa on annettu ohjeistus savusuojatun uloskäytävän testaamisesta.

Palosuojauksen suhteen RakMK ja NFPA ovat hyvin lähellä toisiaan, mutta puolen tunnin palosuojausta ei NFPA:ssa tunneta. Tuttuun tapaan NFPA:ssa on perusteellisemmat ohjeet suojaukseen liittyen, mutta ohjeet voidaan kuitenkin tulkita samanlaisiksi. Erot tulevat lähinnä savusuojauksessa, jonka käsittely on RakMK:ssa lähes olematonta.

4.7 Poistumistien merkitseminen

RakMK:ssa on hyvin vähän ohjeistusta uloskäytävien merkkauksesta. Käytännössä siinä annetaan jopa mahdollisuus jättää merkkaus kokonaan pois tuotantotiloista. Määräysten mukaan tiloista, joista on vaikea löytää tie ulos, on uloskäytävät merkattava. Mikäli uloskäytäviin johtavat ovet tai kulku niille ei ole selkeästi näkyvissä, tai mikäli toiset ovet voivat harhauttaa kulkua, on uloskäytäviin johtavat ovet merkattava.

NFPA:ssa on merkkaus määritelty paljon tarkemmin. Siinä määrätään uloskäytävien merkkaus tehtäväksi niin, että kyltit näkyvät joka lähestymissuunnasta. Lisäksi NFPA:ssa annetaan osittain tarkempiakin ohjeita mille korkeudelle ja mille etäisyydelle ovista kyltti tulee laittaa. Uloskäytäviin johtvat ovet tulee merkata sanalla EXIT. Toisaalta mikäli tilassa on ovia, joita voidaan virheellisesti luulla uloskäytäviin johtaviksi oviksi, tulee nämä ovet merkata kyltein, joissa lukee NO EXIT. NFPA:ssa annetaan myös ohjeistus kirjainkoosta ja kirjaimien välisestä etäisyydestä. Mikäli käynti uloskäytävälle ei ole selvää, tulee käynti uloskäytävälle merkata niin, että lähimmälle kyltille on korkeintaan 30 m matka. Kulkusuunnanmerkkaus on tehtävä tiheämpään paikoissa, joissa ei ole esteetön näkyvyys seuraavalle kyltille. Kulkusuunta tulee esittää nuolin, joka on EXIT sanan vieressä kulkusuuntaan päin. Kyltit on tehtävä sen kokoisina ja sellaisista väreistä, että sitä ei voida sekoittaa sisustukseen tai muihin kyltteihin. Lisäksi NFPA:ssa annetaan määräyksiä kylttien valaistuksen voimakkuudesta ja valaistusajasta, sekä itsehohtavien kylttien hohtovoimakkuudesta ja -ajasta. Yli kaksikerroksisissa rakennuksissa porraskäytävissä pitää muiden kylttien lisäksi olla kerrosmerkkaus. Mikäli portaissa poistumissuunta on ylöspäin, tulee tämäkin merkata.

Sekä RakMK:ssa että NFPA:ssa uloskäytävät tulee merkitä, mutta poikkeuksena RakMK:sta NFPA:ssa vaaditaan myös merkittäväksi ovet, joita voidaan luulla uloskäytäviksi. Lisäksi RakMK:ssa ei varsinaisesti vaadita tuotantotilojen poistumisteitä merkittäviksi, ja sääntö jää tulkinnanvaraiseksi. Kylttien koosta, valaistuksesta, värityksestä jne. ei RakMK:ssa mainita. NFPA:ssa nämä kaikki määritellään osittain hyvinkin yksityiskohtaisesti.

4.8 Poistumistien valaistus

Jos uloskäytävien merkitsemisestä oli hyvin vähän ohjeistusta RakMK:ssa, niin poistumisteiden valaistuksesta on vielä vähemmän. Kuten merkitsemisestä, valaistuksesta on annettu ohjeeksi, että evakuoinnin ollessa hankalaa, on poistumistiet valaistava. NFPA:n mukaan poistumistiet on valaistava aikoina, jolloin niiden käyttö on mahdollista. Mikäli auringonvalo ei riitä, on valaistus hoidettava keinovalaistuksin. Liiketunnistimella varustetut valaisimet ovat sallittuja, kunhan niiden toiminta on varmistettu myös häiriötilanteissa ja valaistus riittää vähintään 15 minuuttia. Vähimmäisvalomäärä on 10,8 luksia mitattuna lattian pinnasta. Valaistus on järjestettävä niin, että yksittäisen valonlähteen häviäminen ei alenna valotasoa missään kohdin 2,2 luksia pienemmäksi. Valaistukseen ei tule ensisijaisesti käyttää paristokäyttöisiä valaisimia, mutta niiden käyttö on sallittu hätätilanteissa.

Tuotantotiloihin vaaditaan hätävalaistus. Mikäli valaistuksen ylläpito vaatii siirtymistä voimanlähteestä toiseen, sallitaan valaistukseen 10 s viive. Hätävalaistus on järjestettävä niin, että se toimii automaattisesti, mikäli ensisijainen valaistus pettää. Hätävalaistus voi toimia joko hätävarageneraattorin voimin tai akkuvoimalla. Hätävalaistuksen tulee olla käytössä joko koko ajan, tai sen tulee toimia automaattisesti ilman käsin tehtävää käynnistystä.

RakMK ei ota kantaa kuinka poistumisteiden valaistus tulisi järjestää. Valaistusta suunniteltaessa voikin olla mielekästä noudattaa NFPA:n määräyksiä, jotka määrittelevät valon määrän ja toiminnan melko tarkasti. NFPA myös erittelee sekä normaalin poistumisteiden valaistuksen että hätävalaistuksen erikseen.

5 JOHTOPÄÄTÖKSET

Tässä luvussa käydään läpi vertailun tulosten perusteella tehdyt johtopäätökset. Lisäksi tässä luvussa annetaan ehdotus jatkotutkimukselle. Nämä perustuvat annettuihin johtopäätöksiin.

5.1 Vertailun johtopäätökset

Huomattava ero National Fire Protection Associationin ja Suomen Rakentamismääräyskokoelman välillä on niiden kattavuudessa. NFPA:ssa käsitellään yksinomaan poistumisteitä yli sadan sivun verran, kun RakMK:ssa poistumisteitä koskevat määräykset käsitellään viidessä sivussa. NFPA:ssa käsitellään asiat paljon yksityiskohtaisemmin kuin RakMK:ssa. Esimerkiksi porraskäytäville annetaan RakMK:ssa vain vaadittu leveys ja palosuojaus, mutta NFPA:ssa käsitellään näiden lisäksi askelmien koko, porraskäytävissä huomioonotettavat merkitsemiset, erilaisten portaiden erityisvaatimukset jne. NFPA:ssa käsitellään myös asioita, joita ei ole lainkaan mainittu RakMK:ssa. Tästä esimerkkinä ovat rampit.

Vertailun perusteella voidaan todeta, että noudattamalla NFPA:n vaatimuksia saadaan paljon enemmän kriteerejä poistumisteiden suunnitteluun. Toisaalta niiltä osin kuin RakMK antaa tarkkoja – numeerisia – vaatimuksia poistumisteille, ovat RakMK:n vaatimukset usein tiukempia kuin NFPA:n. Siksi RakMK:n tarkat vaatimukset täyttämällä täytetään myös NFPA:n vaatimukset, mutta tämän lisäksi rakennettaessa NFPA:n mukaan tulee huomioda ne seikat, jotka RakMK:ssa on jätetty avoimeksi.

Vertailtaessa RakMK:a ja NFPA:a saa vaikutelman, että Suomessa ja Euroopassa ei olla yhtä halukkaita panostamaan paloturvallisuuteen kuin Yhdysvalloissa. Joiltakin osin RakMK:n ote on hyvin löysä, ja tulkinnan varaa jää paljon. Esimerkiksi poistumisteiden merkitseminen ja valaistus voidaan tulkita niin, että tuotantorakennuksissa ei näitä välttämättä tarvita ollenkaan. Toisaalta RakMK:n väljyys ja NFPA:n porsaanreikiäkin tukkiva tarkkuus saattaa kertoa jotain yleisistä kulttuurieroista maiden välillä.

5.2 Jatkotutkimukset

Vaikka RakMK:n poistumisteitä koskevat määräykset eivät olleet yhtä kattavia kuin NFPA:n säännökset, ei se tarkoita ettei muualla RakMK:ssa, Suomen laissa tai Euronormeissa olisi säädetty tarkemmin joistakin poistumisteihin liittyvistä osista. Tästä syystä vertailua voisi täydentää niiltä osin kuin RakMK:n E1-osan poistumisteitä käsittelevä luku joko jättää jonkin aihepiirin vähälle huomiolle tai täysin huomiotta. Esimerkkejä tällaisista ovat oviin, portaisiin ja ramppeihin liittyvät säännökset. Tällä tavalla saataisiin perusteellisempi ja luotettavampi vertailu, josta löytyisi sekä eurooppalaiset että amerikkalaiset poistumisteihin liittyvät standardit yhteen paikkaan koottuna.

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Otsikko	koko-elma	pykälä	määräys	English	Section in comparison
Yleiset vaatimukset	E1	10.1.1	Rakennuksesta tulee voida turvallisesti poistua tulipalossa tai muussa hätätilanteessa. Rakennuksessa tulee olla riittävästi sopivasti sijoitettuja, tarpeeksi väljiä ja helppokulkuisia uloskäytäviä niin, että poistumisaika rakennuksesta ei ole vaaraa aiheuttavan pitkä.	It must be possible to evacuate a building safely in case of fire or other emergency. A building shall be provided with an adequate number of appropriately located exits which are sufficiently spacious and easily passable, so that the time to evacuate the building will not be so long as to cause danger.	1
- Uloskäytävä			Uloskäytävänä ei pidetä hissiä tai muuta vastaavaa laitetta.	A lift or other similar device is not considered as an exit.	1
			Jokaiselta poistumisalueelta on oltava mahdollista kuljet-taa uloskäytävän kautta liikuntakyvytön henkilö paareilla.	It must be possible to transport persons who are immobile through an exit on a stretcher from each evacuation area.	1
- Poistumisalue			Poistumisalueella olevan kulkureitin, joka johtaa uloskäy-tävään, tulee olla riittävän väljä ja helppokulkuinen.	Passageways in an evacuation area, which leads to an exit, must be sufficiently spacious and easily passable.	2
			Uloskäytävään johtavaan kulkureittiin voi sisältyä eri tasojen välinen porras vain, jos mainittujen tasojen voidaan katsoa kuuluvan samaan poistumisalueeseen.	Passageways leading to an exit may include stairs between different levels only if the levels can be considered to belong to the same evacuation area.	5
- Kokoontumispaikka		10.1.2	Uloskäytävän tulee johtaa ulos maan pinnalle tai muulle palon sattuessa turvalliselle paikalle.	Exits shall lead outside to the ground level or to some other safe place in case of fire.	0
Etäisyys uloskäytävään	E1	10.2.1	Etäisyys poistumisalueen kustakin kohdasta uloskäytävään määritetään lyhintä kulkukelpoista reittiä pitkin.	The distance to an exit from each point of an evacuation area is determined along the shortest passable route.	3
			Jos kulkureitit kahteen erilliseen uloskäytävään osittain yhtyvät, yhteisen osan pituus lasketaan kaksinkertaisena.	If the routes to two separate exits partly join, the length of the common part is counted to twice its length.	3
			Mikäli kulkukelpoinen reitti ei ennalta ole tiedossa, etäi-syys määritetään seinien suuntaista reittiä pitkin.	If a passable route is not known beforehand, the distance is determined along a route following the direction of the walls.	3
		10.2.2	Suurin sallittu etäisyys lähimpään uloskäytävään on tuotanto- ja varastotiloissa yleensä 45 m ja kun on vain yksi uloskäytävä 30 m.	The maximum permitted distance to the nearest exit in production and storage occupancies is in general 45 m and 30 m when there is only one exit.	3
			Exception 1 : Yllämainitut etäisyydet voi ylittää seuraavissa tapauksissa:	*Exception 1* : The distances above may be exceeded, if:	3
			(1) poistuminen hätätilanteessa on mahdollista avattavien ikkunoiden kautta maanpinnan tasolla olevasta kerroksesta.	(1) evacuation in case of emergency is possible on a ground-level floor through windows, which can be opened.	3
			(2) rakennus on varustettu automaattisella sammutus-laitteistolla.	(2) the building has been provided with an automatic fire extinguishing system.	3
			Exception 2 : Yllämainittuja arvoja pienempiä kulkureitin enimmäisetäisyyksiä voidaan vaatia silloin, kun tilan erityisestä käytöstä johtuva poikkeuksellinen riski palon nopeaan syttymiseen ja leviämiseen vaarantaa turvallisen poistumisen.	*Exception 2* : Shorter maximum distances of passageways than those above may be required if an exceptional risk of rapid ignition and spread of fire due to a special use of the premises endangers safe evacuation.	3

Uloskäytävien lukimäärä	E1	10.3.1	Rakennuksen jokaiselta poistumisalueelta, jossa muutoin kuin tilapäisesti oleskelee tai työskentelee henkilöitä, tulee yleensä olla vähintään kaksi erillistä, tarkoituksenmukaisesti sijoitettua uloskäytävää.	Each evacuation area of a building where people are staying or working otherwise than temporarily shall in general be provided with at least two separate and appropriately located exits.	1
			Kun uloskäytävä on tarkoitettu vain palossa tai muussa onnettomuustilanteessa käytettäväksi ja kun poistuvien henkilöiden määrä on vähäinen, uloskäytävän ei tarvitse täyttää kaikkia sitä koskevia vaatimuksia.	When an exit is intended to be used only in case of fire or other emergencies and when the number of evacuees is small, the exit does not need to meet all prescribed requirements.	1
		10.3.2	Yksi uloskäytävä sallitaan enintään 8-kerroksisessa rakennuksessa, kun poistumisalueen käyttötapana on asunto, alle 300 h-m2:n työpaikkatila taikka alle 300 h-m2:n tuotanto- tai varastotila. Tällöin poistumisalueilta on lisäksi oltava varatie, jonka kautta pelastautuminen on mahdollista omatoimisesti tai palokunnan toimenpitein.	One exit is allowed in buildings of not more than 8 storeys, if the category of use of the evacuation area is production or storage space of less than 300 h-m2. In these cases the evacuation area must additionally be provided with a fire escape through which it is possible for the evacuees to reach safety on their own means or by the aid of the fire department.	1
- Varatiet			Varatienä voidaan pitää tarkoituksenmukaisesti sijoitettua parveketta tai ikkuna-aukkoa, joiden kautta pelastautumi-nen on mahdollista joko pelastamistoimenpitein tai kiin-teitä tikkaita pitkin taikka muita sopivia rakennusosia hy-väksi käyttäen maanpinnalle tai muulle palon sattuessa turvalliselle paikalle.	An appropriately located balcony or a window opening through which it is possible to escape to the ground level or to some other safe place in case of fire either by rescue actions, along a fixed ladder or by using other suitable building elements, may be considered as a fire escape.	1
			Jos parvekkeelta tai ikkunalta pudottautumiskorkeus maanpinnalle tai muulle palossa turvalliselle paikalle on enintään 3,5 m, ei kiinteitä tikkaita vaadita.	If the drop height from a balcony or a window to the ground level or some other safe place in case of fire is not more than 3,5 m, a fixed ladder is not required.	1
			Jos 2-kerroksisen P3- tai P2-luokan rakennuksen varatienä käytettävältä parvekkeelta tai ikkunalta pudottautumiskor-keus maanpinnalle tai muulle palossa turvalliselle paikalle on yli 3,5 m, pääsy turvaan varmistetaan aina kiinteillä tikkailla.	If the drop height from a balcony or a window used as a fire escape to the ground level or some other safe place in case of fire in a building of class P3 or P2 with 2 storeys is more than 3,5 m, access to safety shall always be secured with a fixed ladder.	1
			Varatienä käytettävä ikkuna tehdään helposti avattavaksi. Sen vapaan aukon korkeus on vähintään 600 mm ja leveys 500 mm siten, että korkeuden ja leveyden summa on vähintään 1500 mm.	A window, which is used as a fire escape, shall be simple to open. Its free opening is at least 600 mm in height and 500 mm in width, so that the sum of height and width is at least 1500 mm.	1
			Varatien järjestämisestä kuullaan paikallista pelastusviranomaista.	The fire escape arrangements shall be negotiated with the local rescue authority.	1
Uloskäytävän mitat	E1	10.4.1	Uloskäytävän vähimmäisleveys lasketaan uloskäytävän kautta poistuvien henkilöiden lukumäärän perusteella. Poistumisalueen henkilömäärä saadaan jakaa eri uloskäytävien osalle ja uloskäytävien leveydet lasketaan yhteen.	The minimum width of an exit is calculated on the basis of the number of occupants evacuating through the exit. The number of occupants of an evacuation area may be distributed between different exits and the widths of the exits are added up.	2

			Henkilöiden määränä on ensisijaisesti käytettävä suurinta poistumisalueelle aiottua henkilömäärää. Jos samaan uloskäytävään liittyy useita poistumisalueita, leveys mitoitetaan henkilömäärältään suurimman poistumisalueen mukaan.	The highest number of occupants intended to be present in an evacuation area shall primarily be used as the number of occupants. If several evacuation areas are connected to the same exit, the width is designed according to the evacuation area with the highest number of occupants.	2
			Mikäli henkilömäärä ei ole tiedossa tai sitä ei muutoin käytetä, se voidaan arvioida tilan pinta-alan ja käyttötavan perusteella, tuotanto- ja varatotiloissa 30 m2/henkilö.	If the number of occupants is not known, or not otherwise used, it may be estimated on the basis of the area and use of the premises, for production and storage occupancies 30 m2/person.	2
			Kun palo-osasto muodostuu useasta avoyhteyksin toisiinsa liittyvästä kerroksesta, jotka ovat omia poistumisalueitaan, henkilöt joutuvat poistumaan samanaikaisesti eri kerroksista samojen uloskäytävien kautta. Tällöin uloskäytävien riittävyys arvioidaan myös kaikkien poistuvien henkilöiden poistumisaikalaskelman perusteella.	When a fire compartment consists of several storeys joined together by open connections, and these storeys form evacuation areas of their own, the occupants have to evacuate from different storeys simultaneously through the same exits. In these cases the adequacy of the exits is assessed also on the basis of a calculation of the evacuation time for all evacuees.	2
- Vähimmäismitta	E1	10.4.2	Uloskäytävän leveyden tulee yleensä olla vähintään 1200 mm.	The width of an exit shall in general be at least 1200 mm.	2
			Uloskäytävän kaventuessa porrashuone varustetaan sisääntulotasolta laukaistavalla savunpoistoluukuulla tai automaattisella savunpoistolaitteistolla.	* When a passageway becomes narrower the staircase shall be equipped with a smoke vent which can be triggeredfrom the entrance level of the staircase or an automatic smoke ejector.	5
			Poistumisalueella, jonka henkilömäärä on enintään 60, saa toinen uloskäytävä olla 900 mm:n levyinen.	In an evacuation area where the maximum number of occupants is 60, the second exit may be 900 mm in width.	2
		10.4.3	Henkilomaaran ylittaessa 120 uloskaytavien yhteenlaskettu vähimmäisleveys lasketaan lisäämällä 1200 mm:iin 400 mm:ä kutakin seuraavaa 60 henkilöä kohden.	The total minimum width of the exits is 1200 mm for the first 120 occupants and the width is increased by 400 mm for each following group of 60 occupants.	2
			Uloskäytävään johtavan sisäisen käytävän leveys lasketaan kuten uloskäytävän leveys käytävää kulkevan henkilömäärän mukaan.	The width of an internal corridor leading to an exit is calculated in the same way as the width of the exits according to the number of occupants passing along the corridor.	2
			Kun palo-osasto muodostuu useasta avoyhteyksin toisiinsa liittyvästä kerroksesta, jotka ovat omia poistumisalueitaan, henkilöt joutuvat poistumaan samanaikaisesti eri ker-roksista samojen uloskäytävien kautta. Tällöin uloskäytävien riittävyys arvioidaan myös kaikkien poistuvien henkilöiden poistumisaikalaskelman perusteella.	* When the fire compartment consists of several open connections between inter-related storeys, which are own exit areas, people need to egress at the same time through same passageways. Then adequacy of the exits is assesd on the basis on the total number of people to be evacuated.	2
			Uloskäytävän leveys mitataan vaakatasossa kohtisuoraan poistumissuuntaa vastaan. Vähimmäisleveyden sisäpuolel-la ei saa olla muita kaventavia esteitä kuin jalkalistat, reu-napalkit ja käsijohteet.	The width of an exit is measured horizontally and perpendicular to the direction of exit. Within the minimum width there shall be no other obstacles reducing the width than skirtings, edge beams or handrails.	2

			Mikäli uloskäytävässä on kulkusuunnassa ovia, voi oviau-kon tai rinnakkain olevien oviaukkojen yhteenlaskettu va-paa leveys olla välttämättömien karmien yhteenlasketun leveyden verran uloskäytävän vähimmäisleveyttä kapeampi.	If there are doors in the exit in the direction of passage, the minimum free exit width of a doorway or the total free width of the doorways located next to each other may be narrowed by the total width of the necessary frames.	2
		10.4.4	Uloskäytävään johtavien ja huoneista sisäiseen käytävään johtavien ovien määrän ja leveyden tulee olla niitä käyttävään henkilömäärään nähden riittäviä.	The number and width of doors leading to exits and from rooms to internal corridors shall be adequate in relation to the number of occupants using them.	1
- Korkeus	E1	10.4.5	Uloskäytävän vapaan korkeuden tulee olla vähintään 2100 mm.	The free height of an exit shall be at least 2100 mm.	2
			Vähimmäiskorkeuden alapuolella ei saa olla esteitä, kuten palkkeja, putkia tai valaisimia. Oviaukkojen kohdalla kor-keus saa olla välttämättömien karmien ja kynnysten verran pienempi.	There shall not be any obstacles, such as beams, pipes or lamps below the minimum height level. At the doorways the height may be reduced as required by necessary frames and thresholds.	2
Uloskäytävän osastointi ja rakenteet	E1	10.5.1	Uloskäytävä muodostetaan yleensä omaksi palo-osastokseen.	An exit is in general considered as a fire compartment of its own.	5
		10.5.2	P1-luokan korkeintaan 24 m korkeassa rakennuksessa, jossa enintään 8 kerrosta, uloskäytävien tulee olla vähintään osastoitu. Yli 24 m korkeissa P1-luokan rakennuksissa, joissa kokreintaan 16 kerrosta uloskäytävien tulee olla palolta suojatut.	The exits in maximum 24 m high buildings of class P1 with maximum 8 stories shall be at least fire-separated. The exits in higher than 24 m high buildings of class P1 with maximum 16 stories shall be at least fire-proof.	5
		10.5.3	Yli kaksikerroksisen P1-luokan rakennuksen uloskäytävän porrassyöksyt ja -tasanteet tulee tehdä vähintään A2-s1, d0-luokan rakennustarvikkeista.	The flights of stairs and landings of an exit in buildings of class P1 with more than two storeys shall be made of building materials at least of class A2–s1, d0.	5
			Porrassyöksyjen ja -tasanteiden tulee täyttää luokan R 30 vaatimukset, kun siihen johtavien tilojen palokuorma on alle 600 MJ/m2. Vastaava vaatimus on R 60, kun palokuorma on tätä suurempi.	The flights of stairs and landings shall meet the requirements of class R 30 when the fire load of the rooms leading to the exit is less than 600 MJ/m2. The corresponding requirement is R 60, when the fire load is higher than that.	5
		10.5.4	P2-luokan rakennuksen porrassyöksyjen ja tasanteiden tulee täyttää luokan R 30 vaatimukset, kun siihen johtavien tilojen palokuorma on alle 600 MJ/m2. Vastaava vaatimus on R 60, kun palokuorma on tätä suurempi.	The flights of stairs and landings in buildings of class P2 shall meet the requirements of class R 30 when the fire load of the rooms leading to the exit is less than 600 MJ/m2. The corresponding requirement is R 60, when the fire load is higher than that.	5
			Vaadittu suojaverhous K2 30, A2-s1, d0 voidaan korvata rakenteella, joka vastaavan ajan suojaa sen takana olevia rakenteita syttymiseltä, hiiltymiseltä tai muulta vaurioitumiselta (EI 30, A2-s1, d0-luokan tarvikkeista).	* The required protective cladding K2 30, A2-s1, d0 can be replaced by a construction that will protect structures behind it from ignition, charring or other damage (EI 30, A2-s1, d0 -class materials).	5

		10.5.5	Uloskäytävään ei saa sijoittaa sellaisia tarvikkeita, rakennusosia eikä laitteita, jotka lisäävät palokuormaa tai savunmuodostuksensa takia vaarantavat henkilöturvallisuutta.	Materials, building elements or facilities which increase the fire load or which endanger life safety through their smoke production must not be placed in exits.	4
Ovien aukeaminen sekä poistumisreittien valaistus ja merkintä					
- Ovet	E1	10.6.1	Uloskäytävän kulkusuunnassa olevien ovien tulee yleensä avautua poistumissuuntaan.	Doors located in the direction of passage in an exit shall in general open in the direction of exit.	4
		10.6.2	Poistumiseen tarvittavan oven tulee avautua poistumissuuntaan, jos sen kautta poistuvien henkilöiden määrä on yli 60.	Doors, which are necessary for exit, shall open in the direction of exit if the number of occupants evacuating through the door exceeds 60.	4
			Näitä ovat ovet, joiden kautta on pääsy ulos, uloskäytä-vään tai uloskäytävään johtavaan sisäiseen käytävään.	Such doors are doors with access to the outside, to an exit or to an internal corridor leading to an exit.	4
		10.6.3	Uloskäytävien ja niihin johtavien tilojen ovien tulee olla hätätilanteessa helposti avattavissa.	The doors of exits and of areas leading to the exits shall be easy to open in an emergency situation.	4
			Uloskäytävien ja niihin johtavien tilojen ovissa ei tule yleensä käyttää lukkoja, jotka avaimetta voi takalukita si-ten, ettei niitä sisäpuolelta saa auki ilman avainta.	Locks, which can be double-bolted without a key in such a way that they cannot be opened from the inside without a key, shall not in general to be used in doors of exits and in doors of areas leading to exits.	4
			Lukkoja, jotka voidaan huoneiston normaalin käytön aikana hätätilanteessa sisäpuolelta avata ilman avainta käytetään tuotanto- ja varastotiloissa.	Locks, which during the normal use of the premises can be opened from the inside without a key in an emergency, are used in production and storage occupancies.	4
			Kulunvalvonnan järjestelyt eivät saa estää turvallista pois-tumista rakennuksesta.	The arrangements for access control must not prevent safe exit from a building.	4
- Merkintä	E1	10.6.4	Poistumisopasteilla tai poistumisreittivalaistuksella tai molemmilla varustetaan sellaiset tilat, joista poistuminen muutoin saattaa olla ilmeisen vaikeata.	Premises, from which evacuation may otherwise be difficult, shall be provided with emergency or exit lighting or both.	6&7
			Sisäasiainministeriö on antanut asetuksen rakennusten poistumisreittien merkitsemisestä ja valaisemisesta (805/2005).	* Ministry of Interior has given a regulation on building escape route marking and lighting (805/2005).	6&7
			Mikäli uloskäytävien ovet ja pääsy niille eivät ole selvästi nähtävissä tai muut ovet voivat harhauttaa ulos pyrkijöitä, uloskäytävät ja pääsy niille tulee tarvittaessa merkitä.	If the doors of exits and the access to them are not clearly visible or if other doors may confuse the evacuees, the exits and the access to them shall be marked, where required.	6&7
		10.6.5	Henkilöturvallisuuden kannalta vaativiin kohteisiin, joissa poistumisturvallisuuden riskit johtuvat tilojen käyttötavasta ja henkilöiden rajoitetusta tai alentuneesta toimintakyvvystä, voidaan	For building works which are demanding from the point of life safety and in which the risks for evacuation safety depend on the use of the premises and the restricted or reduced capabilities of	6
Poistumisaikalaskelma	E1	10.7.1	Poistumisaikalaskelmaa käytetään perusteena, kun laadi-taan kohdan 11.7 mukainen turvallisuusselvitys.	The calculation of the evacuation time is used as a basis for working out the safety assessment set out in clause 11.7.	0

Poistumisaikalaskelma voidaan edellyttää tehtäväksi myös muihin kohteisiin, mikäli niiden suuri koko tai poikkeukselliset olosuhteet voivat vaarantaa henkilöturvallisuutta.	A calculation of the evacuation time may also be necessitated for other building works, if their considerable size or exceptional circumstances may endanger life safety.	0
		0

Subject area	NFPA Code	Paragraph	Rule	Section in comparison
Exclusion	101	40.2.1.2	Normally unoccupied utility chases that are secured from unauthorized access and are used exclusively for routing of electrical, mechanical, or plumbing equipment shall not be required to comply with the provisions of chapter 7 (Code 101B chapter 5).	0
Separation of means of egress	101B	5.1.1.1.8	There shall be no requirements for exit access corridor wall construction.	5
- Exits	101B (101)	5.1.1.2.1 (7.1.3.2.1)	Where an exit is required to be separated from other parts of the building, exits shall meet following requirements:	5
			(A) Separation shall have not less than 1-hour fire resistance rating when connecting 3 stories or less. Opening protectives shall have not less than 1-hour fire protection rating.	5
	(101)	(7.1.3.2.1)	(2) The separation specified in 7.1.3.2.1(1) (Code 101B 5.1.1.2.1(A)) shall be supported by construction having not less than a 1-hour fire resistance rating.	5
			(6) Structural elements, or portions thereof, that support exit components and either penetrate into a fire resistance–rated assembly or are installed within a fire resistance–rated wall assembly shall be protected, as a minimum, to the fire resistance rating required by 7.1.3.2.1(1) (Code 101B 5.1.1.2.1.(A)).	5
	(101B)	(5.1.1.2.1)	(C) Openings therein shall be protected by fire door assemblies equipped with door closers complying with 5.2.1.8.	5
			(D) Openings in exit enclosures shall be limited to those necessary ti access the enclosure from normally occupied spaces and corridors for egress from the enclosure.	5
			(E) Penetrations into and openings throughan exit enclosure assembly shall be prohibited except for electrical conduit serving the stairway, required exit doors, ductwork and equipment necessary for indipendentstair pressuration, water or steam piping necessary for the heating or cooling of the exit enclosure, sprinkler piping and standpipes.	5
			(F) Penetrations or communication openings shall be prohibited between adjecent exit enclosures.	5
	(101)	(7.1.3.2.1)	(12) Membrane penetrations shall be permitted on the exit access side of the exit enclosure and shall be protected in accordance with 8.3.5.6.	5
Headroom in means of egress	101B	5.1.2	Means of egress shall be designed and maintained to provide headroom of not less than 2285 mm with projections of the ceiling not less than 2030 mm nominal height above finished floor. The minimum ceiling height shall be maintained for not less than two-thirds of the ceileng area of any room or space provided the remaining ceiling area is not less than 2 m. Headroom on stairs shall be minimum 2030 mm and shall be measured vertically above a plane parallel to and tangent with the most forward projection of the stair tread.	2
			Exeption : Industrial access walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted a headroom of not less than 2030 mm.	2
Walking surfaces in means of egress	101B	5.1.3.2	Abrubt changes in elevation shall not exceed 6.3 mm. Changes in elevation exceeding 6.3 mmbut not eceeding 13 mm shall be beleved 1 to 2. Changes in elevation exceeding 13 mm shall be considered a change in level and shall be subject to the requirements of 5.1.5.	4

		5.1.3.3	Walking surfaces shall be nominally level. The slope of walking surface in the direction of travel shall not exceed 1 in 20 unless the ramp requirements of 5.2.5 are met. The slope perpendicualr to the directionof travel shall not exceed 1 in 48.	4
		5.1.3.4	Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.	4
Changes in level in means of egress	101	7.1.7.1	Change in level in means of egressshall be achievedby an approved means of egress where the elevation difference exceeds 535 mm.	4
	101B (101)	5.1.4.2 (7.1.7.2)	Changes in level in means of egress not in excess of 535 mm shall be either by a ramp or by a stair that complies with the requirements of 5.2.2. The presence and location of ramped protions of walkways shall be readily apparent. The tread depth of such stair shall not be less than 330 mm and the presence and location of each step shall be readily apparent.	4
			Exception : Industrial access stairs that serve as a component of the means of egress from the involved equipment and do not serve more tahn 20 people shall be permitted a tread depth of not less than 24.5 cm.	4
Guards	101B	5.1.5	Guards in accordance with 5.2.2.4 shall be provided at the open sides of means of egress that are more than 760 mm above the floor or the grade below.	4
Impediments to egress	101B	5.1.6	Any device or alarm installed to restrict the improper use of a means of egress shall be designed and installed so that it cannot, even in case of failure, impede or prevent emergency use of such means of egress.	4
			Exception : Special locking arrangements for means of egress doors as specified in 5.2.1.6	4
Furnishing and decoration in means of egress	101	7.1.10.2.1	No furnishings, decorations, or other objects shall obstruct exits or their access thereto, egress therefrom, or visibility thereof.	4
		7.1.10.2.2	No obstruction by railings, barriers, or gates shall divide the means of egress into sections appurtenant to individual rooms, apartments, or other occupied spaces.	4
Doors	101B	5.2.1.1.2	Every door and every principal entrance that is required to serve as an exit shall be designed and constructed so that the path of egress travel is obvious and direct.	4
		5.2.1.1.3	For the purposes of Section 5.2, a building shall be considered to be occupied at any time it is occupied by more than 10 persons.	0
- width	101B	5.2.1.2.1	In determining the egress width for swinging doors for purposes of calculating capacity, only the clear width of the doorway when the door is open 90 degrees shall be measured. In determining the egress width for other types of doors for purposes of calculating capacity, only the clear width of the doorway when the door is in the full open position shall be measured. Clear width of doorways shall be measured between the face of the door and the stop in accordance with 5.3.2.	2
		5.2.1.2.2	For purposes of determining minimum door width, the door leaf width shall be used unless clear width is specified. Where clear width is specified, there shall be no projections into the required clear door opening width, measured in accordance with 5.2.1.2.1, lower than 865 mm above the floor or ground. Projections into the required clear door opening width that are not less than 865 mm but that do not exceed 1220 mm above the floor or ground shall be limited to the hinge side of each door opening and shall not exceed 100 mm. Projections exceeding 2030 mm above the floor or ground shall not be limited.	2

		5.2.1.2.3	Door openings in means of egress shall be not less than 810 mm in clear width. Where a pair of doors is provided, at least one of the doors shall provide not less than a 810 mm clear width opening.	2
			Exception 1 : Exit access doors serving a room not larger than 6.5 m2 and not required to be accessible to persons in wheelchairs shall be not less than 610 mm in door width.	2
			Exception 2 : Doors serving a building or portion thereof not required to be accessible to persons with severe mobility impairments shall be permitted to be 710 mm in door leaf width.	2
			Exception 3 : A power-operated door leaf located within a two-leaf opening shall be exempt from the minimum 810 mm singleleaf requirement in accordance with Exception 2 to 5.2.1.9.1.	2
- floor level	101B	5.2.1.3	The elevation of the floor surfaces on both sides of a door shall not vary by more than 13 mm. The elevation shall be maintained on both sides of the doorway for a distance not less than the width of the widest leaf. Thresholds at doorways shall not exceed 13 mm in height. Raised thresholds and floor level changes in excess of 6.3 mm at doorways shall be beveled with a slope not steeper than 1 in 2.	4
- swing and force to open	101B	5.2.1.4.1	Any door in a means of egress shall be of the sidehinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging from any position to the full required width of the opening in which it is installed.	4
			Exception 1 : Security grilles as specified in 5.2.1.4.2 shall be permitted.	4
			Exception 2 : Horizontal sliding doors that comply with 5.2.1.14 shall be permitted.	4
			Exception 3 : Doors to private garages and business industrial and storage areas with an occupant load of not more than 10, where such garages and business industrial and storage areas contain lowor ordinary-hazard contents, shall be permitted.	4
		5.2.1.4.4	Doors shall swing in the direction of egress travel if used in an exit enclosure or if serving a high-hazard contents area.	4
		5.2.1.4.5	During its swing, any door in a means of egress shall leave unobstructed not less than one-half of the required width of an aisle, corridor, passageway, or landing and shall not project more than 180 mm into the required width of an aisle, corridor, passageway, or landing when fully open. Doors shall not open directly onto a stair without a landing. The landing shall have a width not less than the width of the door.	4
		5.2.1.4.7	The forces required to fully open any door manually in a means of egress shall not be more than 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width. Opening forces for interior side-hinged or pivotedswinging doors without closers shall not be more than 22 N. These forces shall be applied at the latch stile.	4
			Exception : Power-operated doors as specified in 5.2.1.9.	4
- locks, latches and alarm devices	101B	5.2.1.5.1	Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side of the building.	4
		5.2.1.5.5	A latch or other fastening device on a door shall be provided with a releasing device that has an obvious method of operation and that is readily operated under all lighting conditions. The releasing mechanism for any latch shall be located not less than 865 mm and not more than 1220 mm above the finished floor. Doors shall be openable with not more than one releasing operation.	4

		5.2.1.5.6	Where pairs of doors are required in a means of egress, each leaf of the pair shall be provided with its own releasing device. Devices that depend on the release of one door before the other shall not be used.	4
		5.2.1.5.7	Devices shall not be installed in connection with any door on which panic hardware or fire exit hardware is required if such device prevents or is intended to prevent the free use of the door for purposes of egress.	4
- special locking arrangements	101B	5.2.1.6.1	In industrial occupancies approved, listed, delayed egress locks shall be permitted to be installed on doors serving low- and ordinaryhazard contents in buildings protected throughout by an approved, supervised automatic fire detection system or an approved, supervised automatic sprinkler system, provided the criteria in (A) through (D) are met.	4
			(A) The doors shall unlock upon actuation of an approved, supervised automatic sprinkler system, or upon the actuation of any heat detector or activation of not more than two smoke detectors of an approved, supervised automatic fire detection system.	4
			(B) The doors shall unlock upon loss of power controlling the lock or locking mechanism.	4
			(C) An irreversible process shall release the lock within 15 seconds upon activation of a force to the release device required in 5.2.1.5.5. The force to initiate the lock-releasing process shall not have to be applied continuously for more than 3 seconds. The force applied to initiate the lock-releasing process shall not have to exceed 67 N. The initiation of the release process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only.	4
			(D) On the door adjacent to the release device, there shall be a readily visible, durable sign in letters not less than 25 mm high and not less than 3.2 mm in stroke width on a contrasting background that reads as follows: PUSH UNTILALARM SOUNDS. DOOR CAN BE OPENED IN 15 SECONDS.	4
		5.2.1.6.2	In industrial occupancies doors in the means of egress shall be permitted to be equipped with an approved entrance and egress access control system, provided the following criteria are met:	4
			(1) A sensor, arranged to detect an occupant approaching the doors, shall be provided on the egress side, and the doors shall be arranged to unlock in the direction of egress upon detection of an approaching occupant or loss of power to the sensor.	4
			(2) Loss of power to that part of the access control system that locks the doors shall automatically unlock the doors in the direction of egress.	4
			(3) The doors shall be arranged to unlock in the direction of egress from a manual release device located 1015 mm to 1220 mm vertically above the floor and within 1525 mm of the secured doors. The manual release device shall be readily accessible and clearly identified by a sign that reads as follows: PUSH TO EXIT. When operated, the manual release device shall result in direct interruption of power to the lock — independent of the access control system electronics — and the doors shall remain unlocked for at least 30 seconds.	4
			(4) Activation of the building fire-protective signaling system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.	4

			(5) Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.	4
- panic hardware and fire exit hardware	101B	5.2.1.7.1	In any occupancy any door serving high-hazard contents area with an occupant load of 5 or more persons shall be equipped with panic or fire exit hardware. Such a releasing device shall meet the following criteria:	4
			(1) It shall consist of cross bars or push pads, the actuating portion of which extends across not less than one-half of the width of the door leaf and not less than 865 mm nor more than 1220 mm above the floor.	4
			(2) It shall be constructed so that a horizontal force not exceeding 67 N actuates the cross bar or push pad and latches.	4
		5.2.1.7.2	Only approved panic hardware shall be used on doors that are not fire doors. Only approved fire exit hardware shall be used on fire doors.	4
		5.2.1.7.3	Required panic hardware and fire exit hardware shall not be equipped with any locking device, set screw, or other arrangement that prevents the release of the latch when pressure is applied to the releasing device. Devices that hold the latch in the retracted position shall be prohibited on fire exit hardware.	4
			Exception : Listed and approved devices that hold the latch in the retracted position shall be permitted on fire exit hardware.	4
- self-closing devices	101B	5.2.1.8.1	A door normally required to be kept closed shall not be secured in the open position at any time and shall be self-closing or automatic-closing in accordance with 5.2.1.8.2.	4
		5.2.1.8.2	In any building of low- or ordinary-hazard contents, or where approved by the authority having jurisdiction, doors shall be permitted to be automaticclosing, provided the following criteria are met:	4
			(1) Upon release of the hold-open mechanism, the door becomes self-closing.	4
			(2) The release device is designed so that the door instantly releases manually and upon release becomes self-closing, or the door readily closes.	4
			(3) The automatic releasing mechanism or device is activated by the operation of approved smoke detectors installed in accordance with the requirements for smoke detectors for door release service in NFPA 72, National Fire Alarm Code®.	4
			(4) Upon loss of power to the hold-open device, the holdopen mechanism is released and the door becomes selfclosing.	4
			(5) The release by means of smoke detection of one door in a stair enclosure results in the closing of all doors serving that stair.	4

- powered doors	101B	5.2.1.9.1	Where means of egress doors are operated by power upon the approach of a person or where doors are equipped with power-assisted manual operation, the design shall be such that, in the event of power failure, the door opens manually to allow egress travel or closes where necessary to safeguard the means of egress. The forces required to open these doors manually shall not exceed those required in 5.2.1.4.7, except that the force required to set the door in motion shall not be more than 222 N. The door shall be designed and installed so that, when a force is applied to the door on the side from which egress is made, it shall be capable of swinging from any position to the full use of required width of the opening in which it is installed. (See 5.2.1.4.) On the egress side of each door, there shall be a readily visible, durable sign that reads as follows: IN EMERGENCY, PUSH TO OPEN. The sign shall be in letters not less than 25 mm high on a contrasting background.	4
			Exception 1 : In an exit access that serves an occupant load of fewer than 50, sliding, power-operated doors that manually open in the direction of door travel with forces not exceeding those required in 5.2.1.4.7 shall not be required to have a swing-out feature. The required sign shall read as follows: IN EMERGENCY, PUSH TO OPEN.	4
			Exception 2 : In the emergency break-out mode, a door leaf located within a two-leaf opening shall be exempt from the minimum 810-mm single-leaf requirement of 5.2.1.2.3 if the clear width of the single leaf is at least 760 mm.	4
			Exception 3 : For a biparting sliding door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 810 mm single-leaf requirement of 5.2.1.2.3 if a clear opening of not less than 810 mm is provided by all leafs broken out.	4
			Exception 4 : Doors complying with 5.2.1.14 shall be permitted to be used.	4
		5.2.1.9.2	Where doors are required to be self-closing and (1) are operated by power upon the approach of a person or (2) are provided with power-assisted manual operation, they shall be permitted in the means of egress under the following conditions:	4
			(1) Doors can be opened manually in accordance with 5.2.1.9.1 to allow egress travel in the event of power failure.	4
			(2) New doors remain in the closed position unless actuated or opened manually.	4
			(3) When actuated, new doors remain open for not more than 30 seconds.	4
			(4) Doors are held open for any period of time close — and the power-assist mechanism ceases to function — upon operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening in accordance with the provisions of NFPA72, National Fire Alarm Code.	4
			(5) Doors required to be self-latching are either self-latching or become self-latching upon operation of approved smoke detectors per 5.2.1.9.2(4).	4
			(6) New power-assisted swinging doors comply with BHMA/ ANSI A156.19, American National Standard for Power Assist and Low Energy Power Operated Doors.	4
- horizontal sliding doors	101B	5.2.1.14.1	Horizontal sliding doors shall be permitted in means of egress under the following conditions:	4
			(1) The door is readily operable from either side without special knowledge or effort.	4
			(2) The force, applied to the operating device in the direction of egress, required to operate the door is not more than 67 N.	4

			(3) The force required to operate the door in the direction of door travel is not more than 133 N to set the door in motion and not more than 67 N to close the door or open it to the minimum required width.	4
			(4) The door is operable with a force not more than 222 N when a force of 1110 N is applied perpendicularly to the door adjacent to the operating device.	4
			(5) The door assembly complies with the fire protection rating and, where rated, is self-closing or automatic-closing by smoke detection in accordance with 5.2.1.8.	4
- Additional requirement on horizontal sliding doors in industrial occupancies	101	40.2.2.2.5	Approved existing horizontal-sliding fire doors shall be permitted in the means of egress where they comply with all of the following conditions:	4
			(1) They are held open by fusible links.	4
			(2) The fusible links are rated at not less than 74°C.	4
			(3) The fusible links are located not more than 3050 mm above the floor.	4
			(4) The fusible links are in immediate proximity to the door opening.	4
			(5) The fusible links are not located above a ceiling.	4
			(6) The door is not credited with providing any protection under this Code.	4
Stairs	101	40.2.2.3.1	Stairs shall comply with 7.2.2 (Code 101B 5.2.2) and shall be permitted to be modified by any of the following:	5
			(1) Noncombustible grated stair treads and noncombustible grated landing floors shall be permitted.	5
			(2) Industrial equipment access stairs in accordance with 40.2.5.2 shall be permitted.	5
- dimensional criteria	101	7.2.2.2.1.2	(A) Where the total occupant load of all stories served by the stair is fewer than 50, the minimum width clear of all obstructions, except projections not more than 114 mm at or below handrail height on each side, shall be 915 mm.	2
			(B) Where stairs serve occupant loads exceeding that permitted by 7.2.2.2.1.2(A), the minimum width clear of all obstructions, except projections not more than 114 mm at or below handrail height on each side, shall be 1120 mm when total cumulative occupant load assigned to the stair is less than 2000 persons.	2
	101B	5.2.2.2.1	Maximum height of risers shall be 180 mm.	2
			Minimum height of risers shall be 100 mm.	2
			Minimum tread depth shall be 280 mm.	2
			Minimum headroom shall be 2030 mm.	2
			Maximum height between landings shall be 3660 mm.	2
			Landing - see 5.2.1.3 and 5.2.2.3.2.	2
			Exception : Industrial equipment access stairs and landings that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a clear width not less than 560 mm, a tread depth not less than 255 mm, a riser height not exceeding 230 mm, a headroom not less than 2030 mm, and a height between landings not exceeding 3660 mm.	2
		5.2.2.2.2	Curved stairs shall be permitted as a component in a means of egress where the minimum depth of tread is 280 mm at a point 305 mm from the narrower end of the tread, and the smallest radius is at least twice the stair width.	2

		5.2.2.2.3.2	Spiral stairs shall be permitted, provided the following criteria are met:	2
			(1) Riser heights shall not exceed 180 mm.	2
			(2) The stairway shall have a tread depth of not less than 280 mm for a portion of the stairway width sufficient to provide egress capacity for the occupant load served in accordance with 5.3.3.1.	2
			(3) At the outer side of the stairway, an additional 265 mm of width shall be provided clear to the other handrail, and this width shall not be included as part of the required egress capacity.	2
			(4) Handrails complying with 5.2.2.4 shall be provided on both sides of the spiral stairway.	2
			(5) The inner handrail shall be located within 610 mm, measured horizontally, of the point where a tread depth not less than 280 mm is provided.	2
			(6) The turn of the stairway shall be such that descending users have the outer handrail at their right side.	2
		5.2.2.2.3.3	Where the occupant load served does not exceed three, spiral stairs shall be permitted, provided that the following criteria are met:	2
			(1) The clear width of the stairs shall be not less than 66 cm.	2
			(2) The height of risers shall not exceed 240 mm.	2
			(3) The headroom shall be not less than 1980 mm.	2
			(4) Treads shall have a depth not less than 190 mm at a point 305 mm from the narrower edge.	2
			(5) All treads shall be identical.	2
			(6) Handrails shall be provided on both sides of the stairway.	2
- stair details	101B	5.2.2.3.1	All stairs serving as required means of egress shall be of permanent, fixed construction.	4
		5.2.2.3.2	Stairs shall have landings at door openings. Every landing shall have a dimension measured in the direction of travel that is at least equal to the width of the stair. (See 5.2.1.3.) Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel.	4
			Exception : Landings shall be permitted to be not more than 1220 mm in the direction of travel, provided the stair has a straight run.	4
		5.2.2.3.3	Stair treads and landings shall be solid, without perforations, and free of projections or lips that could trip stair users. If not vertical, risers shall be permitted to slope under the tread at an angle of not more than 30 degrees from vertical; however, the permitted projection of the nosing shall not exceed 38 mm.	4
			Exception : Grated stair treads and landing floors shall be permitted in industrial occupancies.	4
		5.2.2.3.4	Tread slope shall not exceed a slope of 1 in 48.	4
		5.2.2.3.5	Riser height shall be measured as the vertical distance between tread nosings. Tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge, but tread depth shall not include beveled or rounded tread surfaces that slope more than 20 degrees (a slope of 1 in 2.75). At tread nosings, such beveling or rounding shall not exceed 13 mm in horizontal dimension.	2
		5.2.2.3.6	There shall be no variation exceeding 4.8 mm in the depth of adjacent treads or in the height of adjacent risers, and the tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 9.5 mm in any flight.	4

			Exception : Where the bottom riser adjoins a sloping public way, walk, or driveway having an established grade and serving as a landing, a variation in height of the bottom riser not exceeding 75 mm in every 915 mm of stairway width shall be permitted.	4
- Guards and handrails	101B	5.2.2.4.1	Means of egress that are more than 760mm above the floor or grade below shall be provided with guards to prevent falls over the open side. (See also 5.2.2.4.6.).	4
		5.2.2.4.2	Stairs and ramps shall have handrails on both sides. In addition, handrails shall be provided within 760 mm of all portions of the required egress width of stairs. The required egress width shall be along the natural path of travel. (See also 5.2.2.4.5.) (See 7.2.10 for exemption to this requirement.)	4
			Exception: If part of a curb separates a sidewalk from a vehicular way, a single step or a ramp shall not be required to have a handrail.	4
		5.2.2.4.3	Required guards and handrails shall continue for the full length of each flight of stairs. At turns of stairs, inside handrails shall be continuous between flights at landings.	4
		5.2.2.4.4	The design of guards and handrails and the hardware for attaching handrails to guards, balusters, or walls shall be such that there are no projections that might engage loose clothing. Openings in guards shall be designed to prevent loose clothing from becoming wedged in such openings.	4
- Handrail details	101B	5.2.2.4.5.1	Handrails on stairs or ramps shall have a consistent height of at least 865 mm and not more than 965 mm above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the tread or the ramp walking surface.	4
			Exception 1 : The height of required handrails that form part of a guard shall be permitted to be not more than 1065 mm, measured vertically to the top of the rail from the leading edge of the tread.	4
			Exception 2 : Additional handrails that are lower or higher than the main handrail shall be permitted.	4
		5.2.2.4.5.2	Handrails shall provide a clearance of not less than 38 mm between the handrail and the wall to which it is fastened.	4
		5.2.2.4.5.3	Handrails shall have a circular cross section with an outside diameter of not less than 32 mm and not more than 51 mm.	4
			Exception: Any other shape with a perimeter dimension of not less than 100 mm, but not more than 160 mm, and with the largest cross-sectional dimension not more than 57 mm shall be permitted, provided that edges are rounded so as to provide a minimum radius of 3.2 mm.	4
		5.2.2.4.5.4	Handrails shall be continuously graspable along the entire length.	4
			Exception : Handrail brackets or balusters attached to the bottom surface of the handrail shall not be considered to be obstructions to graspability, provided the following criteria are met:	4
			(1) They do not project horizontally beyond the sides of the handrail within 38 mm of the bottom of the handrail and provided that, for each 13 mm of additional handrail perimeter dimension above 100 mm (4 in.), the vertical clearance dimension of 38 mm can be reduced by 3 mm.	4
			(2) They have edges with a radius of not less than 0.25 mm.	4
			(3) They obstruct not in excess of 20 percent of the handrail length if the graspable perimeter dimension is less than 140 mm.	4
		5.2.2.4.5.5	Handrail ends shall be returned to the wall or floor or shall terminate at newel posts.	4

		5.2.2.4.5.6	Handrails that are not continuous between flights shall extend horizontally, at the required height, not less than 305 mm beyond the top riser and continue to slope for a depth of one tread beyond the bottom riser.	4
- Guard details	101B	5.2.2.4.6.1	The height of guards required in 5.2.2.4.1 shall be measured vertically to the top of the guard from the surface adjacent thereto.	4
		5.2.2.4.6.2	Guards shall be not less than 1065 mm high.	4
		5.2.2.4.6.3	Open guards shall have intermediate rails or an ornamental pattern such that a sphere 100 mm in diameter shall not pass through any opening up to a height of 865 mm.	4
			Exception : The triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 150 mm in diameter shall not pass through the triangular opening.	4
- Enclosure and protection of stairs	101B	5.2.2.5.1	All inside stairs serving as an exit or exit component shall be enclosed in accordance with 5.1.1.2.	5
		5.2.2.5.2	Where nonrated walls or unprotected openings enclose the exterior of a stairway and the walls or openings are exposed by other parts of the building at an angle of not more than 180 degrees, the building enclosure walls within 3050 mm horizontally of the nonrated wall or unprotected opening shall be constructed as required for stairway enclosures, including opening protectives. Construction shall extend vertically from the ground to a point 3050 mm above the topmost landing of the stairs or to the roofline, whichever is lower.	5
			Exception : The fire resistance rating of the separation extending 3050 mm from the stairs shall not be required to be more than 1 hour with openings having a 3⁄4-hour fire resistance rating.	5
		5.2.2.5.3	There shall be no enclosed, usable space within an exit enclosure, including under stairs, nor shall any open space within the enclosure be used for any purpose that has the potential to interfere with egress.	5
			Exception : Enclosed usable space shall be permitted under stairs if the space is separated from the stair enclosure by the same fire resistance as the exit enclosure. Entrance to such enclosed usable space shall not be from within the stair enclosure. (See also 5.1.1.2.3.)	5
- Stairway identification	101	7.2.2.5.4.1	New enclosed stairs serving three or more stories shall comply with 7.2.2.5.4.1(A) through 7.2.2.5.4.1(O).	6
			(A) The stairs shall be provided with special signage within the enclosure at each floor landing.	6
			(B) The signage shall indicate the floor level.	6
			(C) The signage shall indicate the terminus of the top and bottom of the stair enclosure.	6
			(D) The signage shall indicate the identification of the stair enclosure.	6
			(E) The signage shall indicate the floor level of, and the direction to, exit discharge.	6
			(F) The signage shall be located inside the stair enclosure.	6
			(G) The bottom of the signage shall be located a minimum of 1220 mm above the floor landing, and the top of the signage shall be located a maximum of 84 in. (2135 mm) above the floor landing.	6
			(H) The signage shall be in a position that is visible when the door is in the open or closed position.	6
			(I) The signage shall comply with 7.10.8.1 (Code 101B 5.10.5) and 7.10.8.2 of this Code.	6
			(J) The floor level designation shall also be tactile in accordance with ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities.	6

			(K) The signage shall be painted or stenciled on the wall or on a separate sign securely attached to the wall.	6
			(L) The stairway identification shall be located at the top of the sign in minimum 25 mm high lettering and shall be in accordance with 7.10.8.2.	6
			(M) Signage that reads NO ROOF ACCESS shall designate stairways that do not provide roof access. Lettering shall be a minimum of 1 in. (25 mm) high and shall be in accordance with 7.10.8.2.	6
			(N) The floor level number shall be located below the stairway identifier in minimum 125 mm high numbers and shall be in accordance with 7.10.8.2. Mezzanine levels shall have the letter “M” or other appropriate identification letter preceding the floor number, while basement levels shall have the letter “B” or other appropriate identification letter preceding the floor level number.	6
			(O) Identification of the lower and upper terminus of the stairway shall be on the sign in minimum 25 mm high letters or numbers and shall be in accordance with 7.10.8.2.	6
	101B	5.2.2.5.5	Where an enclosed stair requires travel in an upward direction to reach the level of exit discharge, signs with directional indicators that indicate the direction to the level of exit discharge shall be provided at each floor level landing from which upward direction of travel is required. Such signage shall be readily visible when the door is in the open or closed position.	6
			Exception 1 : Where signs required by Code 101 7.2.2.5.4 are provided.	6
			Exception 2 : Stairs that extend not more than one story below the level of exit discharge where the exit discharge is clearly obvious.	6
	101	7.2.2.5.4.3	Where new contrasting marking is applied to stair treads, such marking shall comply with all of the following:	6
			(1) The marking shall include a continuous strip as a coating on, or as a material integral with, the full width of the leading edge of each tread.	6
			(2) The marking shall include a continuous strip as a coating on, or as a material integral with, the full width of the leading edge of each landing nosing.	6
			(3) The marking strip width, measured horizontally from the leading vertical edge of the nosing, shall be consistent at all nosings.	6
			(4) The marking strip width shall be 25 mm to 51 mm.	6
		7.2.2.5.4.4	Where new contrast marking is provided for stairway handrails, it shall be applied to, or be part of, at least the upper surface of the handrail; have a minimum width of 13 mm; and extend the full length of each handrail. After marking, the handrail shall comply with Code 101B 5.2.2.4.5. Where handrails or handrail extensions bend or turn corners, the stripe shall be permitted to have a gap of not more than 100 mm.	6
- Special provision for outside stairs	101B	5.2.2.6.2	Outside stairs shall be arranged to avoid any impediments to the use of the stairs by persons having a fear of high places. For stairs more than three stories in height, any arrangement intended to meet this requirement shall be no less than 1220 mm in height.	4
		5.2.2.6.3	Outside stairs shall be separated from the interior of the building by walls with the fire resistance rating required for enclosed stairs with fixed or self-closing opening protectives. This construction shall extend vertically from the ground to a point 3050 mm above the topmost landing of the stairs or to the roofline, whichever is lower, and no less than 3050 mm horizontally.	5

			Exception 1 : Outside stairs serving an exterior exit access balcony that has two remote outside stairways or ramps shall be permitted to be unprotected.	5
			Exception 2 : Outside stairs serving not more than two adjacent stories, including the story of exit discharge, shall be permitted to be unprotected where there is a remotely located second exit.	5
			Exception 3 : The fire resistance rating of the separation extending 3050 mmfrom the stairs shall not be required to be more than 1 hour with openings having a 3⁄4-hour fire protection rating.	5
		5.2.2.6.4	All openings below an outside stair shall be protected with an assembly having a 3⁄4-hour fire protection rating under one of the following conditions:	5
			(1) Where located in a court, the smallest dimension of which is not more than one-third its height.	5
			(2) Where located in an alcove having a width not exceeding one-third its height and a depth exceeding one-fourth its height.	5
		5.2.2.6.5	Outside stairs and landings shall be designed to minimize water accumulation on their surfaces.	4
		5.2.2.6.6	Outside stairs shall be at least 50 percent open on one side and shall be arranged to restrict the accumulation of smoke.	4
Smokeproof enclosures	101B	5.2.3.1	Smokeproof enclosures shall be permitted to be used in the means of egress. Where smokeproof enclosures are used in the means of egress, they shall conform to the general requirements of Section 5.1, the special requirements of 5.2.3, and the building code.	5
		5.2.3.2	A smokeproof enclosure shall be enclosed from the highest point to the lowest point by barriers that have 2-hour fire resistance ratings. Where a vestibule is used, it shall be within the 2-hour rated enclosure and shall be considered part of the smokeproof enclosure.	5
		5.2.3.3	Where a vestibule is provided, the doorway into the vestibule shall be protected with an approved fire door assembly that has a 11⁄2-hour fire protection rating, and the fire door assembly from the vestibule to the smokeproof enclosure shall have at least a 20-minute fire protection rating. Doors shall be designed to minimize air leakage and shall be self-closing or shall be automatic-closing by actuation of a smoke detector within 3050 mm of the vestibule door.	5
		5.2.3.4	Every smokeproof enclosure shall discharge into a public way, into a yard or court having direct access to a public way, or into an exit passageway. Such exit passageways shall be without openings other than the entrance from the smokeproof enclosure and the door to the outside yard, court, or public way. The exit passageway shall be separated from the remainder of the building by a 2-hour fire resistance rating.	5
- Natural ventilation	101	7.2.3.7	Smokeproof enclosures using natural ventilation shall comply with Code 101B 5.2.3.2 and all of the following:	5
			(1) Where access to the enclosure is by means of an open exterior balcony, the door assembly to the enclosure shall have a minimum 11⁄2-hour fire protection rating and shall be self-closing or shall be automatic-closing by actuation of a smoke detector.	5
			(2) Openings adjacent to the exterior balcony specified in 7.2.3.7(1) shall be protected in accordance with Code 101B 5.2.2.6.4.	5
			(3) Every vestibule shall have a net area of not less than 1.5 m2 of opening in an exterior wall facing an exterior court, yard, or public space not less than 6100 mm in width.	5

			(4) Every vestibule shall have a minimum dimension of not less than the required width of the corridor leading to it and a dimension of not less than 1830 mm in the direction of travel.	5
- Mechanical ventilation	101	7.2.3.8	Smokeproof enclosures using mechanical ventilation shall comply with 7.2.3.3 and the requirements of 7.2.3.8.1 through 7.2.3.8.4.	5
		7.2.3.8.1	Vestibules shall have a dimension of not less than 1120 mm in width and not less than 1830 mm in the direction of travel.	5
		7.2.3.8.2	The vestibule shall be provided with not less than one air change per minute, and the exhaust shall be 150 percent of the supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate tightly constructed ducts used only for such purposes. Supply air shall enter the vestibule within 150 mm of the floor level. The top of the exhaust register shall be located not more than 150 mm below the top of the trap and shall be entirely within the smoke trap area. Door leaves, when in the open position, shall not obstruct duct openings. Controlling dampers shall be permitted in duct openings if needed to meet the design requirements.	5
		7.2.3.8.3	To serve as a smoke and heat trap and to provide an upward-moving air column, the vestibule ceiling shall be not less than 510 mm higher than the door opening into the vestibule. The height shall be permitted to be decreased where justified by engineering design and field testing.	5
		7.2.3.8.4	The stair shall be provided with a dampered relief opening at the top and supplied mechanically with sufficient air to discharge at least 70.8 m3/min through the relief opening while maintaining a positive pressure of not less than 25 N/m2 in the stair, relative to the vestibule with all door leaves closed.	5
- Enclosure pressurization	101	7.2.3.9.1	Smokeproof enclosures using pressurization shall use an approved engineered system with a design pressure difference across the barrier of not less than 12.5 N/m2 in sprinklered buildings, or 25 N/m2 in nonsprinklered buildings, and shall be capable of maintaining these pressure differences under likely conditions of stack effect or wind. The pressure difference across door openings shall not exceed that which allows the door leaves to begin to be opened by a force of 133 N in accordance with Code 101B 5.2.1.4.7.	5
		7.2.3.9.2	Equipment and ductwork for pressurization shall be located in accordance with one of the following specifications:	5
			(1) Exterior to the building and directly connected to the enclosure by ductwork enclosed in noncombustible construction	5
			(2) Within the enclosure with intake and exhaust air vented directly to the outside or through ductwork enclosed by a 2-hour fire-resistive rating	5
			(3) Within the building under the following conditions:	5
			(a) Where the equipment and ductwork are separated from the remainder of the building, including other mechanical equipment, by a 2-hour fire-resistive rating	5
			(b) Where the building, including the enclosure, is protected throughout by an approved, supervised automatic sprinkler system, and the equipment and ductwork are separated from the remainder of the building, including other mechanical equipment, by not less than a 1-hour fire-resistive rating	5
		7.2.3.9.3	In all cases specified by 7.2.3.9.2(1) through (3), openings into the required fire resistance–rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire protection-rated devices in accordance with 8.3.4.	5

- Activation of mechanical ventilation and pressurized enclosure systems	101	7.2.3.10.1	For both mechanical ventilation and pressurized enclosure systems, the activation of the systems shall be initiated by a smoke detector installed in an approved location within 3050 mm of each entrance to the smokeproof enclosure.	5
		7.2.3.10.2	The required mechanical system shall operate upon the activation of the smoke detectors specified in 7.2.3.10.1 and by manual controls accessible to the fire department. The required system also shall be initiated by the following, if provided:	5
			(1) Waterflow signal from a complete automatic sprinkler system	5
			(2) General evacuation alarm signal	5
- Door leaf closers	101	7.2.3.11	The activation of an automaticclosing device on any door leaf in the smokeproof enclosure shall activate all other automatic-closing devices on door leaves in the smokeproof enclosure.	5
- Emergency power system (EPSS)	101	7.2.3.12	Power shall be provided as follows:	5
			(1) A Type 60, Class 2, Level 2 EPSS for new mechanical ventilation equipment shall be provided in accordance with NFPA 110, Standard for Emergency and Standby Power Systems.	5
			(2) A previously approved existing standby power generator installation with a fuel supply adequate to operate the equipment for 2 hours shall be permitted in lieu of 7.2.3.12(1).	5
			(3) The generator shall be located in a room separated from the remainder of the building by fire barriers having a minimum 1-hour fire resistance rating.	5
- Testing	101	7.2.3.13	Before the mechanical equipment is accepted by the authority having jurisdiction, it shall be tested to confirm that it is operating in compliance with the requirements of 7.2.3 (Code 101B Section 5.2.3). All operating parts of the system shall be tested semiannually by approved personnel, and a log shall be kept of the results.	5
Ramps	101	40.2.2.6	Ramps complying with any of the following shall be permitted:	4
			(1) Ramps in accordance with 7.2.5 (Code 101B 5.2.5)	4
			(2) Industrial equipment access in accordance with 40.2.5.2	4
	101B	5.2.5.1	Ramps shall be permitted to be used in the means of egress. Where ramps are used in the means of egress, they shall conform to the general requirements of Section 5.1 and to the special requirements of 5.2.5.	4
- Dimensional criteria	101B	5.2.5.2	Minimum width clear of all obstructions, except projections not more than 90 mm at or below handrail height on each side shall be 1120 mm.	2
			Maximum slope shall be 1 in 12.	2
			Maximum cross slope shall be 1 in 48.	2
			Maximum rise for a single ramp run shall be 760 mm.	2
			Exception 1 : Where not part of an accessible means of egress, ramps shall be permitted to have a slope not steeper than 1 in 8.	2
			Exception 2 : Industrial equipment access ramps and landings that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a minimum clear width of 560 mm and a maximum height between landings of 3660 mm.	2

			Exception 3 : Ramps that provide access to vehicles, vessels, mobile structures, and aircraft shall not be required to comply with the maximum slope or maximum rise for a single ramp run.	2
- Construction	101B	5.2.5.3.1.1	All ramps that serve as required means of egress shall be of permanent fixed construction.	4
		5.2.5.3.1.2	Ramp floor and landings shall be solid and without perforations.	4
- Landings	101B	5.2.5.3.2.1	Ramps shall have landings at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width at least the width of the ramp. Every landing shall be not less than 1525 mm long in the direction of travel.	4
		5.2.5.3.2.2	Any changes in travel direction shall be made only at landings. Such landings shall have minimum dimensions of 1525 mm × 1525 mm.	4
- Details	101B	5.2.5.3.3	Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from traveling off the edge of the ramp. Curbs or barriers shall be no less than 100 mm in height.	4
- Guards and handrails	101B	5.2.5.4	Guards that comply with 5.2.2.4 shall be provided for ramps. Handrails that comply with 5.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 150 mm. The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.	4
- Enclosures and protection of ramps	101B	5.2.5.5	Ramps in a required means of egress shall be enclosed or protected as a stair in accordance with 5.2.2.5 and 5.2.2.6. The use of Exception 2 to 5.2.2.6.3 shall be prohibited.	5
- Special provision of outside ramps	101B	5.2.5.6.1	Outside ramps shall be arranged to avoid any impediments to their use by persons having a fear of high places. For ramps more than three stories in height, any arrangement intended to meet this requirement shall be no less than 1220 mm in height.	4
		5.2.5.6.2	Outside ramps and landings shall be designed to minimize water accumulation on their surfaces.	4
Exit passageways	101B	5.2.6.1	Exit passageways shall be permitted to be used in the means of egress. Where exit passageways are used in the means of egress, they shall conform to the general requirements of Section 5.1 and to the special requirements of 5.2.6.	4
		5.2.6.2	An exit passageway shall be separated from other parts of the building as specified in 5.1.1.2.	5
			Exception : Fire windows shall be permitted to be installed in such a separation in a building protected throughout by an approved, supervised automatic sprinkler system.	5
		5.2.6.3	An exit passageway that serves as a discharge from a stair enclosure shall have not less than the same fire resistance rating and opening protective fire protection rating as those required for the stair enclosure.	5
		5.2.6.4	The width of an exit passageway shall be adequate to accommodate the aggregate required capacity of all exits discharging through it.	2
			Exception : Where an exit passageway serves occupants of the level of exit discharge as well as other stories, capacity shall not be required to be aggregated.	2
		5.2.6.5	The floor shall be solid and without perforations.	4
Fire escape stairs	101B	5.2.8	Fire escape stairs shall not constitute any of the required means of egress.	1
Fire escape ladders	101B	5.2.9.1	Fire escape ladders shall be permitted in the means of egress to provide any of the following:	1

			(1) Access to unoccupied roof spaces.	1
			(3) A means of egress from towers and elevated platforms around machinery or similar spaces subject to occupancy by no more than three persons.	1
			(4) A secondary means of egress from boiler rooms or similar spaces subject to occupancy by no more than three persons.	1
	101	40.2.2.10.2	Fixed industrial stairs in accordance with the minimum requirements for fixed stairs and stair railing systems in ANSI/ASSE A1264.1, Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrails Systems, shall be permitted where fire escape ladders are permitted in accordance with 7.2.9.1 (Code 101B 5.2.9.1).	1
- Construction and installations	101B	5.2.9.2.1	Fire escape ladders shall comply with ANSI A14.3, Safety Requirements for Fixed Ladders.	1
			Exception : In industrial occupancies, industrial stairs that comply with the minimum requirements for fixed stairs of ANSI A1264.1, Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems, shall be permitted where fire escape ladders are permitted.	1
		5.2.9.2.2	Ladders shall be installed with a pitch of not less than 75 degrees.	1
		5.2.9.2.3	The lowest rung of any ladder shall not be more than 305 mm above the level of the surface beneath it.	1
Capacity of means of egress	101	40.2.3	Capacity of means of egress shall comply with either 40.2.3.1 or 40.2.3.2.	2
		40.2.3.1	The capacity of means of egress shall be in accordance with Section 7.3 (Code 101B Section 5.3).	2
		40.2.3.2	In industrial occupancies, means of egress shall be sized to accommodate the occupant load as determined in accordance with 40.1.7; spaces not subject to human occupancy because of the presence of machinery or equipment shall not be included in the computation.	2
		40.1.7	The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Code 101 7.3.1.2 (Code 101B 5.3.1.2) that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.	2
- Occupan load	101B	5.3.1.1	The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.	2
		5.3.1.2	The occupant load in any building or portion thereof shall be at least the number determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified:	2
			General and high hazard industrial: 9.3 m2 per person.	2
			Special purpose industrial: the occupant load shall be the maximum number of persons to occupy the area under any probable conditions.	2
			If both gross and net area figures are given for the same occupancy, the following calculations shall be made:	2
			(1) Applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified	2
			(2) Applying the net area figure to the net area of the specific use for which the net area figure is specified	2

			Exception : In a special-purpose industrial occupancy, the occupant load shall be the maximum number of persons to occupy the area under any probable conditions.	2
		5.3.1.3.1	The occupant load permitted in any building or portion thereof shall be permitted to be increased from that number established for the given use in accordance with 5.3.1.2, where all other requirements of this Code are also met, based on such increased number.	2
		5.3.1.3.2	The authority having jurisdiction shall be permitted to require an approved aisle, seating, or fixed equipment diagram to substantiate any increase in occupant load and shall be permitted to require that such diagram be posted in an approved location.	2
		5.3.1.4	Where exits serve more than one story, the occupant load of each story considered individually shall be permitted to be used in computing the capacity of the exits at that story, provided that the required egress capacity of the exit is not decreased in the direction of egress travel.	2
		5.3.1.5	Where means of egress from stories above and below converge at an intermediate story, the capacity of the means of egress from the point of convergence shall be not less than the sum of the two.	2
		5.3.1.6	Where any required egress capacity from a balcony or mezzanine passes through the room below, that required capacity shall be added to the required egress capacity of the room in which it is located.	2
- Measurement of means of egress	101B	5.3.2	Width of means of egress shall be measured in the clear at the narrowest point of the exit component under consideration within not more than 2030 mm above the floor.	2
			Exception : For egress components, projections not exceeding 90 mm on each side shall be permitted at and below a height of 965 mm.	2
- Egress capacity	101B	5.3.3.1	Egress capacity for approved components of means of egress shall be based on the capacity factors:	2
			High-hazard contents: stairways 18 mm per person; level components and ramps 10 mm per person	2
			Other (industrial): stariways 7.6 mm per person; level components and ramps 5 mm per person	2
	101	7.3.3.2	For stairways wider than 1120 mm and subject to the 7.6 mm width per person capacity factor, the capacity shall be permitted to be increased using the following equation:	2
			$$C = 146.7 + \left(\frac{Wn - 44}{0.218} \right)$$	2
			Where:	2
			C = capacity, in persons, rounded to nearest intergrer	2
			Wn = nominal width of the stairs as permitted by 7.3.2.2 (0.3 in.)	2
	101B	5.3.3.2	The required capacity of a corridor shall be the occupant load utilizing the corridor for exit access divided by the required number of exits to which the corridor connects, but the required capacity shall be at least that of the exit to which the corridor leads.	2
- Minimum width	101B	5.3.4	The minimum width of any means of egress shall be that required by this chapter for a given egress component and shall be not less than 915 mm.	2

			Exception 1: The minimum width of an exit access formed by furniture and movable partitions, serving not more than six people, and not more than 15 m in length, shall be at least 455 mm at and below a height of 965 mm or 710 mm above a height of 965 mm if the minimum 915 mm width can be provided without moving permanent walls.	2
			Exception 2: Doors as specified for in 5.2.1.2 shall not be required to meet the minimum width requirement.	2
			Exception 3: Industrial equipment access walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a minimum 560 mm clear width.	2
Number of means of egress	101	40.2.4.1	The number of means of egress shall comply with either 40.2.4.1.1 or 40.2.4.1.2.	1
		40.2.4.1.1	Not less than two means of egress shall be provided from every story or section, and not less than one exit shall be reached without traversing another story.	1
		40.2.4.1.2	A single means of egress shall be permitted from any story or section in low and ordinary hazard industrial occupancies, provided that the exit can be reached within the distance permitted as a common path of travel.	1
		40.2.4.3	Areas with high hazard contents shall comply with Section 7.11 (Code 101B Section 5.11).	1
	101B	5.4.1	The minimum number of means of egress from any balcony, mezzanine, story, or portion thereof shall be two unless otherwise specified by this section.	1
		5.4.1.1	A mezzanine or balcony shall be permitted to have a single means of egress where the common path of travel limitations of 5.5.1.8 are met.	1
		5.4.1.6	In low- and ordinary-hazard industrial occupancies, a single means of egress shall be permitted from any story or section if the exit can be reached within 15 m or 30 m in buildings protected throughout by an approved, supervised automatic sprinkler system.	1
		5.4.4	In industrial occupancies, where a minimum of two means of egress are required, a minimum of one exit shall be reached without traversing another story.	1
		5.4.7	Accessible means of egress, in accordance with 5.5.4, not utilizing elevators shall be permitted to serve as any or all of the required minimum number of means of egress.	1
		5.4.8	Only the occupant load of each story considered individually shall be required to be used in computing the number of means of egress at that story, provided that the required number of means of egress is not decreased in the direction of egress travel.	1
- Spaces about electrical equipment	101	7.4.2.1	600 Volts, Nominal, or less. The minimum number of means of egress for working space about electrical equipment, shall be in accordance with NFPA70, National Electrical Code, Section 110.26(C).	1
		7.4.2.2	Over 600 Volts, Nominal. The minimum number of means of egress for working space about electrical equipment shall be in accordance with NFPA70, National Electrical Code, Section 110.33(A).	1
Arrangement of means of egress	101B	5.5.1.1	Exits shall be located and exit access shall be arranged such that exits are readily accessible at all times.	1

5.5.1.2	Where exits are not immediately accessible from an open floor area, continuous passageways, aisles, or corridors leading directly to every exit shall be provided and shall be arranged to provide access for each occupant to at least two exits by separate paths of travel. Exit access corridors shall provide access to at least two approved exits without passing through any intervening rooms other than corridors, lobbies, and other spaces permitted to be open to the corridor.	1
	Exception 1 : Where a single exit is permitted by Section 5.4.	1
	Exception 2 : Common paths of travel as permitted by 5.5.1.8.	1
	Exception 3 : Corridors that are not required to be fire resistance rated shall be permitted to discharge into open floor plan areas.	1
5.5.1.3	Where more than one exit is required from a building or portion thereof, such exits shall be remotely located from each other and shall be arranged and constructed to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition.	1
5.5.1.4	Where two exits or exit access doors are required, they shall be placed at a distance from each other that is equal to and not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by a minimum 1-hour fire resistance–rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor. (See 7.2.29 for exemption to these requirements.) Where more than two exits or exit access doors are required, at least two of the required exits or exit access doors shall be arranged to comply with this section. The other exits or exit access doors shall be located so that, if one becomes blocked, the others are available.	1
	Exception : In buildings protected throughout by an approved, supervised automatic sprinkler system, the minimum separation distance between two exits or exit access doors, measured in accordance with 5.5.1.4, shall be at least one-third the length of the maximum overall diagonal dimension of the building or area to be served.	1
5.5.1.6	Exit access shall be arranged so that there are no dead ends in corridors.	1
	Exception : Dead ends as permitted by 5.5.1.8.	1
5.5.1.7	Exit access from rooms or spaces shall be permitted to be through adjoining or intervening rooms or areas, provided such adjoining rooms are accessory to the area served and are not hazardous areas. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening rooms. (See also 5.5.2.)	1
5.5.1.8	Common paths of travel shall be limited to:	1
	Industrial - general and specail puprose: unsprinkled 15 m; sprinkled 30 m	1
	Industrial - high hazard: not allowed	1
	Dead-end corridors shall be limited to:	1
	Industrial - general and special purpose: unsprikled and sprinkled 15 m	1
	Industrial - high hazard: not allowed	1

- Industrial occupancy anciliary facilities	101B	5.5.1.10.1	Industrial occupancy ancillary facilities shall be arranged to allow travel in independent directions after leaving the ancillary facility so that both means of egress paths do not become compromised by the same fire or similar emergency.	1
		5.5.1.10.2	Ancillary facilities in special-purpose industrial occupancies where delayed evacuation is anticipated shall have no less than a 2-hour fire resistance–rated separation from the predominant industrial occupancy and shall have one means of egress that is separated from the predominant industrial occupancy by 2-hour fire resistance–rated construction.	1
- Impediments to egress	101B	5.5.2.1	In no case shall access to an exit be through kitchens, storerooms, restrooms, workrooms, closets, bedrooms or similar spaces, or other rooms subject to locking.	1
		5.5.2.2	Exit access and exit doors shall be designed and arranged to be clearly recognizable. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.	1
- Exterior paths of exit access	101B	5.5.3.1	Exit access shall be permitted to be by means of any exterior balcony, porch, gallery, or roof that conforms to the requirements of this chapter.	1
		5.5.3.2	The long side of the balcony, porch, gallery, or similar space shall be at least 50 percent open and shall be arranged to restrict the accumulation of smoke.	1
		5.5.3.3	Exterior exit access balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.	1
			Exception 1 : Where the exterior exit access balcony is served by at least two remote stairs that are accessed without any occupant needing to travel past an unprotected opening to reach one of the stairs.	1
			Exception 2 : Where dead ends on the exterior exit access do not exceed 6100 mm.	1
		5.5.3.4	Exterior exit access shall be arranged such that there are no dead ends in excess of those permitted for dead-end corridors by 5.5.1.8.	1
- Accessible means of exit	101B	5.5.4.1	Areas accessible to people with severe mobility impairment shall have at least two accessible means of egress. (See 3.3.69.1, Accessible Means of Egress.) Access shall be provided to no less than one area of refuge or to one accessible exit that provides an accessible route to an exit discharge, within the allowable travel distance.	1
			Exception : Exit access travel along the accessible means of egress shall be permitted to be common for the distances permitted as common paths of travel.	1
		5.5.4.2	If two accessible means of egress are required, the exits serving these paths shall be placed at a distance from each other of not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. If exit enclosures are provided as the required exits and are interconnected by a minimum 1-hour fire resistance–rated corridor conforming to the requirements of 5.1.1.1, exit separation shall be permitted to be measured along the line of travel within the corridor.	1
			Exception 1 : Buildings protected throughout by an approved, supervised automatic sprinkler system.	1
			Exception 2 : Where the physical arrangement of means of egress prevents the possibility that access to both accessible means of egress will be blocked by any one fire or other emergency condition as approved by the authority having jurisdiction.	1

		5.5.4.3	Each required accessible means of egress shall be continuous from each accessible occupied area to a public way or area of refuge in accordance with 5.2.12.2.2.	1
		5.5.4.4	Where an exit stair is used in an accessible means of egress, it shall comply with 5.2.12.2.3 and either shall incorporate an area of refuge within an enlarged story-level landing or shall be accessed from an area of refuge.	1
		5.5.4.6	A smoke barrier that additionally has a minimum 1-hour fire resistance rating, and a horizontal exit in accordance with 5.2.4, to be considered part of an accessible means of egress, shall discharge to an area of refuge in accordance with 5.2.12.	1
- Industrial equipment access	101	40.2.5.3.1	Industrial equipment access doors, walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment shall be permitted in accordance with the applicable provisions of Chapter 7 (Code 101B Chapter 5), as modified:	2
			Minimum horizontal dimension of any walkway, landing, or platform 560 mm clear	2
			Minimum stair or ramp width 560 mm clear between rails	2
			Minimum tread width 560 mm clear	2
			Minimum tread depth 255 mm	2
			Maximum riser height 230 mm	2
			Handrails are permitted to terminate, at the required height, at a point directly above the top and bottom risers.	2
			Maximum height between landings 3660 mm	2
			Minimum headroom 2030 mm	2
			Minimum width of door openings 560 mm clear	2
		40.2.5.3.2	Any means of egress component permitted by 40.2.5.3.1 shall serve not more than 20 people.	2
Measure of travel distance to exits	101	40.2.6.1	Travel distance, measured in accordance with Section 7.6 (Code 101B section 5.6), shall not exceed:	3
			Industrial - general: unsprinkled 61 m; sprinkled 76 m (in one story buildings, a travel distance of 122 m is permitted, provided that a performance-based analysis demonstrates that safe egress can be accomplished.)	3
			Industrial - special purpose: unsprinkled 91 m; sprinkled 122 m	3
			Industrial - high hazard: unsprinkled not allowed; sprinkled 23 m.	3
			Exception : When permitted by 40.2.6.2.	3
	101B	5.6.2	The travel distance to an exit shall be measured on the floor or other walking surface along the centerline of the natural path of travel, starting from the most remote point subject to occupancy, curving around any corners or obstructions with a 305-mm (12-in.) clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. If measurement includes stairs, the measurement shall be taken in the plane of the tread nosing.	3
		5.6.3	If open stairways or ramps are permitted as a path of travel to required exits, the distance shall include the travel on the stairway or ramp and the travel from the end of the stairway or ramp to an outside door or other exit in addition to the distance traveled to reach the stairway or ramp.	3
		5.6.4	Travel distance limitations shall be as specified in Code 101 40.2.6.1 and for high-hazard areas in accordance with Code 101B Section 5.11.	3

		5.6.5	If any part of an exterior exit is within 3050 mm horizontal distance of any unprotected building opening, as permitted in the Exceptions to 5.2.2.6.3 for outside stairs, the travel distance to the exit shall include the length of travel to ground level.	3
- Power generation buildings	101	40.2.6.2	Buildings of noncombustible construction used exclusively for the enclosure of steam generators, steam turbines, gas turbines, heat recovery generators, and flue gas treatment equipment shall be permitted to have a maximum travel distance of 122 m, where all special hazards are protected by approved automatic suppression systems in accordance with one or more of the following standards, as applicable:	3
			(1) NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam	3
			(2) NFPA 12, Standard on Carbon Dioxide Extinguishing Systems	3
			(3) NFPA 13, Standard for the Installation of Sprinkler Systems	3
			(4) NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection	3
			(5) NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems	3
			(6) NFPA 17, Standard for Dry Chemical Extinguishing Systems	3
			(7) NFPA 750, Standard on Water Mist Fire Protection Systems	3
			(8) NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems	3
Discharge from exits	101B	5.7.1	All exits shall terminate at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with access to a public way.	0
		5.7.2	Not more than 50 percent of the required number of exits, and not more than 50 percent of the required egress capacity, shall be permitted to discharge through areas on the level of exit discharge, provided that the requirements of (A), (B), and (C) are met.	0
			(A) Such discharge shall lead to a free and unobstructed path to the exterior of the building, and such path shall be readily visible and identifiable from the point of discharge from the exit.	0
			(B) The level of discharge shall be protected throughout by an approved, automatic sprinkler system, or the portion of the level of discharge used for this purpose shall be protected by an approved, automatic sprinkler system and separated from the nonsprinklered portion of the floor by a fire resistance rating that meets the requirements for the enclosure of exits (see 5.1.1.2.1).	0
			(C) The entire area on the level of discharge shall be separated from areas below by construction that has a fire resistance rating no less than that required for the exit enclosure.	0
		5.7.3	The exit discharge shall be arranged and marked to make clear the direction of egress to a public way. Stairs shall be arranged so as to make clear the direction of egress to a public way. Stairs that continue more than one-half story beyond the level of exit discharge shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.	0
		5.7.4	Doors, stairs, ramps, corridors, exit passageways, bridges, balconies, escalators, moving walks, and other components of an exit discharge shall comply with the detailed requirements of this chapter for such components.	0

Illumination of means of egress	101B	5.8.1.1	Illumination of means of egress shall be provided in accordance with this section for every building and structure. For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways, and exit passageways leading to a public way.	7
		5.8.1.2	Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time asrequired to maintain the illumination to the minimum criteriavalues herein specified.	7
			Exception : Automatic, motion sensor–type lighting switches shall be permitted within the means of egress, provided that switch controllers are equipped for fail-safe operation, illumination timers are set for no less than a 15-minute duration, and the motion sensor is activated by any occupant movement in the area served by the lighting units.	7
		5.8.1.3	The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 5.8.1.1 shall be illuminated to values of not less than 10.8 lux measured at the floor.	7
	101	7.8.1.3	(1) During conditions of stair use, the minimum illumination of new stairs shall be at least 108 lux, measured at the walking surfaces.	7
	101B	5.8.1.4	Required illumination shall be arranged so that the failure of any single lighting unit will not result in an illumination level in any designated area of less than 2.2 lux.	7
		5.8.1.5	The equipment or units installed to meet the requirements of Section 5.10 shall be permitted also to serve the function of illumination of means of egress, provided that all requirements of Section 5.8 for such illumination are met.	7
- Source of illumination	101B	5.8.2.1	Illumination of means of egress shall be from a source considered reliable by the authority having jurisdiction.	7
		5.8.2.2	Battery-operated electric lights and other types of portable lamps or lanterns shall not be used for primary illumination of means of egress. Battery-operated electric lights shall be permitted to be used as an emergency source to the extent permitted by Section 5.9.	7
Emergency lighting and standby power	101B	5.9.1.1	Emergency lighting facilities for means of egress shall be provided in accordance with this section for the following:	7
			(1) Industrial occupancies exept special purpose without routine occupancy, or daylight operations with windows.	7
			(3) High-rise buildings.	7
			(4) At doors equipped with delayed egress locks.	7
		5.9.1.2	For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways that lead to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, ramps, aisles, walkways, and escalators that lead to a public way.	7
		5.9.1.3	Where maintenance of illumination depends on changing from one energy source to another, a delay of not more than 10 seconds shall be permitted.	7

- Performance of system	101B	5.9.2.1	Emergency illumination shall be provided for a period of 1½ hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 10.8 lux and a minimum at any point of 1.1 lux, measured along the path of egress at floor level. Illumination levels shall be permitted to decline to an average of 6.5 lux and a minimum at any point of 0.65 lux at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.	7
		5.9.2.2	The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting, such as any failure of a public utility or other outside electrical power supply; the opening of a circuit breaker or fuse; or any manual act(s), including accidental opening of a switch controlling normal lighting facilities.	7
		5.9.2.3	Emergency generators that provide power to emergency lighting systems shall be installed in accordance with NFPA 110, Standard for Emergency and Standby Power Systems. Stored electrical energy systems, where required in this Code, shall be installed in accordance with NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems.	7
		5.9.2.4	Battery-operated emergency lights shall use only reliable types of rechargeable batteries provided with suitable facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with NFPA 70, National Electrical Code.	7
		5.9.2.5	The emergency lighting system either shall be continuously in operation or shall be capable of repeated automatic operation without manual intervention.	7
- Standby power	101B	5.9.3	High-rise buildings shall be provided with Class 1, Type 60 standby power in accordance with NFPA 70, National Electrical Code, and NFPA 110, Standard for Emergency and Standby Power Systems. The standby power system shall have a capacity and rating sufficient to supply all required equipment. Selective load pickup and load shedding shall be permitted in accordance with NFPA 70. The standby power system shall be connected to the following:	7
			(1) Emergency lighting system.	7
			(2) At least one elevator serving all floors and transferable to any elevator. (Note! Elevators excluded from this comparison.)	7
			(3) Mechanical equipment for smokeproof enclosures.	7
Marking of means of egress	101B	5.10.1.1	Means of egress shall be marked in accordance with this section for every building and structure except Special purpose industrial occupancies without routine occupancy, or daylight operations with windows.	6
		5.10.1.2	Exits, other than main exterior exit doors that obviously and clearly are identifiable as exits, shall be marked by an approved sign readily visible from any direction of exit access.	6
		5.10.1.3	Tactile signage shall be located at each door into an exit stair enclosure, and such signage shall read as follows: EXIT. Signage shall comply with ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities, and shall be installed adjacent to the latch side of the door 152 cm above the finished floor to the centerline of the sign.	6

		5.10.1.4	Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants. Sign placement shall be such that no point in an exit access corridor exceeds the rated viewing distance or 30 m, whichever is less, from the nearest sign.	6
		5.10.1.7	Every sign required in Section 5.10 shall be located and of such size, distinctive color, and design that it is readily visible and shall provide contrast with decorations, interior finish, or other signs. No decorations, furnishings, or equipment that impairs visibility of a sign shall be permitted. No brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision of the required exit sign that could detract attention from the exit sign shall be permitted.	6
- Directional signs	101B	5.10.2	A sign complying with 5.10.3 with a directional indicator showing the direction of travel shall be placed in every location where the direction of travel to reach the nearest exit is not apparent.	6
- Sign legend	101B	5.10.3	Signs required by 5.10.1 and 5.10.2 shall have the word EXIT or other appropriate wording in plainly legible letters.	6
			Exception : Where approved by the authority having jurisdiction, pictograms shall be permitted.	6
- Power source	101B	5.10.4	Where emergency lighting facilities are required by 5.9.1.1, the signs, other than approved selfluminous signs and listed photoluminescent signs in accordance with 5.10.7.2, shall be illuminated by the emergency lighting facilities. The level of illumination of the signs shall be in accordance with 5.10.6.3 or 5.10.7 for the required emergency lighting duration as specified in 5.9.2.1. However, the level of illumination shall be permitted to decline to 60 percent at the end of the emergency lighting duration.	6
- Illumination of signs	101B	5.10.5.1	Every sign required by 5.10.1.2 or 5.10.1.4, other than where operations or processes require low lighting levels, shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be legible in both the normal and emergency lighting mode.	6
		5.10.5.2	Every sign required to be illuminated by 5.10.6.3 and 5.10.7 shall be continuously illuminated as required under the provisions of Section 5.8.	6
			Exception : Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.	6
- Externally illuminated signs	101B	5.10.6.1	Externally illuminated signs required by 5.10.1 and 5.10.2 shall have the word EXIT or other appropriate wording in plainly legible letters not less than 150 mm high, with the principal strokes of letters not less than 19 mm wide. The word EXIT shall have letters of a width not less than 5 cm, except the letter I, and the minimum spacing between letters shall be not less than 9.5 mm. Signs larger than the minimum established in this paragraph shall have letter widths, strokes, and spacing in proportion to their height.	6
			Exception 1 : This requirement shall not apply to marking required by 5.10.1.3 and 5.10.1.5.	6
			Exception 2 : Where approved by the authority having jurisdiction, pictograms shall be permitted.	6
		5.10.6.2	The directional indicator shall be located outside of the EXIT legend, not less than 9.5 mm from any letter. The directional indicator shall be of a chevron type, as shown in Figure 5.10.6.2. The directional indicator shall be identifiable as a directional indicator at a distance of 12m. A directional indicator larger than the minimum established in this paragraph shall be proportionately increased in height, width, and stroke. The directional indicator shall be located at the end of the sign for the direction indicated.	6

				6

FIGURE 5.10.6.2 Chevron-Type Indicator.

		5.10.6.3	Externally illuminated signs shall be illuminated by not less than 54 lux at the illuminated surface and shall have a contrast ratio of not less than 0.5.	6
- Internally illuminated signs	101B	5.10.7.1	Internally illuminated signs shall be listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment.	6
			Exception : This requirement shall not apply to signs that are in accordance with 5.10.1.3 and 5.10.1.6.	6
		5.10.7.2	The face of a photoluminescent sign shall be continually illuminated while the building is occupied. The illumination levels on the face of the photoluminescent sign shall be in accordance with its listing. The charging illumination shall be a reliable light source as determined by the authority having jurisdiction. The charging light source shall be of a type specified in the product markings.	6
- Special signs	101	7.10.8.2	Special signs, where required by other provisions of this Code, shall comply with the visual character requirements of ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities.	6
	101B	5.10.8.1	Any door, passage, or stairway that is neither an exit nor a way of exit access and that is located or arranged so that it is likely to be mistaken for an exit shall be identified by a sign that reads as follows: NO EXIT. Such sign shall have the word NO in letters 5 cm high with a stroke width of 9.5 mm and the word EXIT in letters 2.5 cm high, with the word EXIT below the word NO.	6
Special provisions for occupancies with high-hazard contents	101B	5.11.1	Where the contents are classified as high hazard, exits of such types and numbers shall be provided and arranged to permit all occupants to escape from the building or structure or from the hazardous area thereof to the outside or to a place of safety with a travel distance of not more than 23 m, measured as required in 5.6.2.	3
			Exception : A travel distance of not more than 45 m shall be permitted where flammable and combustible products are stored and protected in accordance with NFPA 30, Flammable and Combustible Liquids Code.	3
		5.11.2	Egress capacity for high-hazard contents areas shall be based on 18 mm per person for stairs or 10 mm per person for level components and ramps in accordance with 5.3.3.1.	2
		5.11.3	At least two means of egress shall be provided from each building or hazardous area thereof.	1
			Exception : Rooms or spaces not more than 18.6 m2 and having an occupant load of not more than three persons and a travel distance to the room door of not more than 7620 mm.	1

		5.11.4	Means of egress shall be arranged so that there are no dead ends in corridors.	1
			Exception : Spaces meeting the requirements of the Exception to 5.11.3.	1
		5.11.5	Doors that serve high-hazard contents areas with occupant loads of more than five shall be permitted to be provided with a latch or lock only if it is panic hardware or fire exit hardware that complies with 5.2.1.7.	4
Mechanical equipment rooms, boiler rooms and furnace rooms	101B	5.12.1	Mechanical equipment rooms, boiler rooms, furnace rooms, and similar spaces shall be arranged to limit common path of travel to not more than 15 m.	3
			Exception : A common path of travel not more than 30 m shall be permitted in either of the following:	3
			(1) In buildings protected throughout by an approved, supervised automatic sprinkler system.	3
			(2) In mechanical equipment rooms with no fuel-fired equipment.	3
		5.12.2	Stories used exclusively for mechanical equipment, furnaces, or boilers shall be permitted to have a single means of egress where the travel distance to an exit on that story is not more than the common path of travel limitations of 5.12.1.	1

Restrictions NFPA

* Buildings 1-3 stories.
* No discharge to roofs.
* No horizontal exits.
* No area of refugee (in side)
* No escalators or elevators (as means of egress).
* No slide escapes.
* No alternating tread devices.
* No interlocking or scissor stairs.
* No underground structures.
* No towers.
* No subdivision of building space via smoke partitions.
* Occupant load less than 500.

Restrictions RakMK

* P1 tai P2 (korkeintaan yksi kerros) luokan rakennus.
* Korkeintaan 3 kerrosta.

Area of refuge:	An area that is either (1) a story in a building where the building is protected throughout by an approved, supervised automatic sprinkler system and has not less than two accessible rooms or spaces separated from each other by smoke-resisting partitions; or (2) a space located in a path of travel leading to a public way that is protected from the effects of fire, either by means of separation from other spaces in the same building or by virtue of location, hereby permitting a delay in egress travel from any level.
Authority having jurisdition:	The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.
Externally illuminated:	Having the property of emanating from a source that is contained outside of the device or sign legend area that is to be illuminated.
General industrial occupancy:	An industrial occupancy in which ordinary and low hazard industrial operations are conducted in buildings of conventional design suitable for
Hazardous area:	An area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure, such as those areas used for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; or heatproducing appliances.
High hazard industrial occupancy:	An industrial occupancy in which industrial operations that include high hazard materials, processes, or contents are conducted.
High rise building:	A building greater than 23 m in height where the building height is measured from the lowest level of fire department vehicle access to the floor of the highest occupiable story.
Industrial occupancy:	An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted.
Internally illuminated:	Having the property of emanating from a source that is contained inside the device or legend that is illuminated.
Public way:	A street, alley, or other similar parcel of land essentially open to the outside air deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 3 m.
Special purpose industrial occupancy:	An industrial occupancy in which ordinary and low hazard industrial operations are conducted in buildings designed for and suitable only for particular types of operations, characterized by a relatively low density of employee population, with much of the area occupied by machinery or equipment.

A1	Tarvikkeet, jotka eivät osallistu lainkaan paloon.
A2	Tarvikkeet, joiden osallistuminen paloon on erittäin rajoitettu.
B	Tarvikkeet, joiden osallistuminen paloon on hyvin rajoitettu.
C	Tarvikkeet, jotka osallistuvat paloon rajoitetusti.
D	Tarvikkeet, joiden osallistuminen paloon on hyväksyttävissä.
E	Tarvikkeet, joiden käyttäytyminen palossa on hyväksyttävissä.
F	Tarvikkeet, joiden käyttäytymistä ei ole määritetty.
s1	Savuntuotto on erittäin vähäistä.
s2	Savuntuotto on vähäistä.
s3	Savuntuotto ei täytä s1 eikä s2 vaatimuksia.
d0	Palavia pisaroita tai osia ei esiinny.
d1	Palavat pisarat tai osat sammuvat nopeasti.
d2	Palavien pisaroiden tai osien tuotto ei täytä d0 eikä d1 vaatimuksia.
P1, P2, P3	Paloluokka
R30, R60	Kantavuus minuuteissa
EI 60	Tiiviys ja eristävyys minuuteissa

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
0. General						
	E1	10.1.2	Exits shall lead outside to the ground level or to some other safe place in case of fire.	101B	5.7.1	All exits shall terminate at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with access to a public way.
				101B	5.7.2	Not more than 50 percent of the required number of exits, and not more than 50 percent of the required egress capacity, shall be permitted to discharge through areas on the level of exit discharge, provided that the requirements of (A), (B), and (C) are met. (A) Such discharge shall lead to a free and unobstructed path to the exterior of the building, and such path shall be readily visible and identifiable from the point of discharge from the exit. (B) The level of discharge shall be protected throughout by an approved, automatic sprinkler system, or the portion of the level of discharge used for this purpose shall be protected by an approved, automatic sprinkler system and separated from the nonsprinklered portion of the floor by a fire resistance rating that meets the requirements for the enclosure of exits (see 5.1.1.2.1). (C) The entire area on the level of discharge shall be separated from areas below by construction that has a fire resistance rating no less than that required for the exit enclosure.
				101B	5.7.3	The exit discharge shall be arranged and marked to make clear the direction of egress to a public way. Stairs shall be arranged so as to make clear the direction of egress to a public way. Stairs that continue more than one-half story beyond the level of exit discharge shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.
				101B	5.7.4	Doors, stairs, ramps, corridors, exit passageways, bridges, balconies, escalators, moving walks, and other components of an exit discharge shall comply with the detailed requirements of this chapter for such components.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
	E1	10.3.1	When an exit is intended to be used only in case of fire or other emergencies and when the number of evacuees is small, the exit does not need to meet all prescribed requirements.	101	40.2.1.2	Normally unoccupied utility chases that are secured from unauthorized access and are used exclusively for routing of electrical, mechanical, or plumbing equipment shall not be required to comply with the provisions of chapter 7 (Code 101B chapter 5).
				101B	5.2.1.1.3	For the purposes of Section 5.2, a building shall be considered to be occupied at any time it is occupied by more than 10 persons.
	E1	10.7.1	For building works which are demanding from the point of life safety and in which the risks for evacuation safety depend on the use of the premises and the restricted or reduced capabilities of the occupants, a calculation of the evacuation time for the specific building work may be necessitated.			
	E1	10.7.1	The calculation of the evacuation time is used as a basis for working out the safety assessment set out in clause 11.7.			
	E1	10.7.2	A calculation of the evacuation time may also be necessitated for other building works, if their considerable size or exceptional circumstances may endanger life safety.			
1. Number of exits						
	E1	10.4.4	The number and width of doors leading to exits and from rooms to internal corridors shall be adequate in relation to the number of occupants using them.	101	40.2.4.1	The number of means of egress shall comply with either 40.2.4.1.1 or 40.2.4.1.2.
				101	40.2.4.1.1	
	E1	10.3.1	Each evacuation area of a building where people are staying or working otherwise than temporarily shall in general be provided with at least two separate and appropriately located exits.			Not less than two means of egress shall be provided from every story or section, and not less than one exit shall be reached without traversing another story.
				101	40.2.4.1.2	A single means of egress shall be permitted from any story or section in low and ordinary hazard industrial occupancies, provided that the exit can be reached within the distance permitted as a common path of travel. (See Code 101B 5.4.1.6)
	E1	10.3.2	One exit is allowed in buildings of not more than 8 storeys, if the category of use of the evacuation area is production or storage space of less than 300 h-m2. In these cases the evacuation area must additionally be provided with a fire escape through which it is possible for the evacuees to reach safety on their own means or by the aid of the fire department.	101	40.2.4.3	Areas with high hazard contents shall comply with Section 7.11 (Code 101B Section 5.11).
				101B	5.4.1	The minimum number of means of egress from any balcony, mezzanine, story, or portion thereof shall be two unless otherwise specified by this section.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.4.1.1	A mezzanine or balcony shall be permitted to have a single means of egress where the common path of travel limitations of 5.5.1.8 are met.
				101B	5.4.1.6	In low- and ordinary-hazard industrial occupancies, a single means of egress shall be permitted from any story or section if the exit can be reached within 15 m or 30 m in buildings protected throughout by an approved, supervised automatic sprinkler system.
				101B	5.4.4	In industrial occupancies, where a minimum of two means of egress are required, a minimum of one exit shall be reached without traversing another story.
				101B	5.4.7	Accessible means of egress, in accordance with 5.5.4, not utilizing elevators shall be permitted to serve as any or all of the required minimum number of means of egress.
				101B	5.4.8	Only the occupant load of each story considered individually shall be required to be used in computing the number of means of egress at that story, provided that the required number of means of egress is not decreased in the direction of egress travel.
				101	7.4.2.1	600 Volts, Nominal, or less. The minimum number of means of egress for working space about electrical equipment, shall be in accordance with NFPA70, National Electrical Code, Section 110.26(C).
				101	7.4.2.2	Over 600 Volts, Nominal. The minimum number of means of egress for working space about electrical equipment shall be in accordance with NFPA70, National Electrical Code, Section 110.33(A).
				101B	5.12.2	Stories used exclusively for mechanical equipment, furnaces, or boilers shall be permitted to have a single means of egress where the travel distance to an exit on that story is not more than the common path of travel limitations of 5.12.1.
Occupancies with high hazard contents				101B	5.11.3	At least two means of egress shall be provided from each building or hazardous area thereof. *Exception* : Rooms or spaces not more than 18.6 m2 and having an occupant load of not more than three persons and a travel distance to the room door of not more than 7620 mm.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
Alternative exits	E1	10.3.2	An appropriately located balcony or a window opening through which it is possible to escape to the ground level or to some other safe place in case of fire either by rescue actions, along a fixed ladder or by using other suitable building elements, may be considered as a fire escape.	101B	5.5.3.1	Exit access shall be permitted to be by means of any exterior balcony, porch, gallery, or roof that conforms to the requirements of this chapter.
				101B	5.5.3.2	The long side of the balcony, porch, gallery, or similar space shall be at least 50 percent open and shall be arranged to restrict the accumulation of smoke.
				101B	5.5.3.3	Exterior exit access balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors. *Exception 1* : Where the exterior exit access balcony is served by at least two remote stairs that are accessed without any occupant needing to travel past an unprotected opening to reach one of the stairs. *Exception 2* : Where dead ends on the exterior exit access do not exceed 6100 mm.
				101B	5.5.3.4	Exterior exit access shall be arranged such that there are no dead ends in excess of those permitted for dead-end corridors by 5.5.1.8.
	E1	10.3.2	If the drop height from a balcony or a window used as a fire escape to the ground level or some other safe place in case of fire in a building of class P3 or P2 with 2 storeys is more than 3,5 m, access to safety shall always be secured with a fixed ladder.	101B	5.2.9.1	Fire escape ladders shall be permitted in the means of egress to provide any of the following: (1) Access to unoccupied roof spaces. (3) A means of egress from towers and elevated platforms around machinery or similar spaces subject to occupancy by no more than three persons. (4) A secondary means of egress from boiler rooms or similar spaces subject to occupancy by no more than three persons.
	E1	10.3.2	If the drop height from a balcony or a window to the ground level or some other safe place in case of fire is not more than 3,5 m, a fixed ladder is not required.			
				101	40.2.2.10.2	Fixed industrial stairs in accordance with the minimum requirements for fixed stairs and stair railing systems in ANSI/ASSE A1264.1, Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrails Systems, shall be permitted where fire escape ladders are permitted in accordance with 7.2.9.1 (Code 101B 5.2.9.1).
				101B	5.2.9.2.1	Fire escape ladders shall comply with ANSI A14.3, Safety Requirements for Fixed Ladders.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						Exception : In industrial occupancies, industrial stairs that comply with the minimum requirements for fixed stairs of ANSI A1264.1, Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems, shall be permitted where fire escape ladders are permitted.
				101B	5.2.9.2.2	Ladders shall be installed with a pitch of not less than 75 degrees.
				101B	5.2.9.2.3	The lowest rung of any ladder shall not be more than 305 mm above the level of the surface beneath it.
	E1	10.3.2	A window, which is used as a fire escape, shall be simple to open. Its free opening is at least 600 mm in height and 500 mm in width, so that the sum of height and width is at least 1500 mm.			
	E1	10.3.2	The fire escape arrangements shall be negotiated with the local rescue authority.			
Arrangement of exits	E1	10.1.1	It must be possible to evacuate a building safely in case of fire or other emergency. A building shall be provided with an adequate number of appropriately located exits which are sufficiently spacious and easily passable, so that the time to evacuate the building will not be so long as to cause danger.	101B	5.5.1.1	Exits shall be located and exit access shall be arranged such that exits are readily accessible at all times.
				101B	5.5.1.2	Where exits are not immediately accessible from an open floor area, continuous passageways, aisles, or corridors leading directly to every exit shall be provided and shall be arranged to provide access for each occupant to at least two exits by separate paths of travel. Exit access corridors shall provide access to at least two approved exits without passing through any intervening rooms other than corridors, lobbies, and other spaces permitted to be open to the corridor.
						Exception 1 : Where a single exit is permitted by Section 5.4.
						Exception 2 : Common paths of travel as permitted by 5.5.1.8.
						Exception 3 : Corridors that are not required to be fire resistance rated shall be permitted to discharge into open floor plan areas.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.5.1.3	Where more than one exit is required from a building or portion thereof, such exits shall be remotely located from each other and shall be arranged and constructed to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition.
				101B	5.5.1.4	Where two exits or exit access doors are required, they shall be placed at a distance from each other that is equal to and not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by a minimum 1-hour fire resistance–rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor. (See 7.2.29 for exemption to these requirements.) Where more than two exits or exit access doors are required, at least two of the required exits or exit access doors shall be arranged to comply with this section. The other exits or exit access doors shall be located so that, if one becomes blocked, the others are available.
						Exception : In buildings protected throughout by an approved, supervised automatic sprinkler system, the minimum separation distance between two exits or exit access doors, measured in accordance with 5.5.1.4, shall be at least one-third the length of the maximum overall diagonal dimension of the building or area to be served.
				101B	5.5.1.6	Exit access shall be arranged so that there are no dead ends in corridors. *Exception* : Dead ends as permitted by 5.5.1.8.
				101B	5.5.1.7	Exit access from rooms or spaces shall be permitted to be through adjoining or intervening rooms or areas, provided such adjoining rooms are accessory to the area served and are not hazardous areas. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening rooms. (See also 5.5.2.)

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.5.1.8	Common paths of travel shall be limited to: Industrial - general and specail puprose: unsprinkled 15 m; sprinkled 30 m Industrial - high hazard: not allowed Dead-end corridors shall be limited to: Industrial - general and special purpose: unsprikled and sprinkled 15 m Industrial - high hazard: not allowed
					5.5.1.10.1	Industrial occupancy ancillary facilities shall be arranged to allow travel in independent directions after leaving the ancillary facility so that both means of egress paths do not become compromised by the same fire or similar emergency.
					5.5.2.1	In no case shall access to an exit be through kitchens, storerooms, restrooms, workrooms, closets, bedrooms or similar spaces, or other rooms subject to locking.
					5.5.2.2	Exit access and exit doors shall be designed and arranged to be clearly recognizable. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.
	E1	10.1.1	It must be possible to transport persons who are immobile through an exit on a stretcher from each evacuation area.	101B	5.5.4.1	Areas accessible to people with severe mobility impairment shall have at least two accessible means of egress. (See 3.3.69.1, Accessible Means of Egress.) Access shall be provided to no less than one area of refuge or to one accessible exit that provides an accessible route to an exit discharge, within the allowable travel distance. *Exception* : Exit access travel along the accessible means of egress shall be permitted to be common for the distances permitted as common paths of travel.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
					5.5.4.2	If two accessible means of egress are required, the exits serving these paths shall be placed at a distance from each other of not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. If exit enclosures are provided as the required exits and are interconnected by a minimum 1-hour fire resistance–rated corridor conforming to the requirements of 5.1.1.1, exit separation shall be permitted to be measured along the line of travel within the corridor.
						Exception 1 : Buildings protected throughout by an approved, supervised automatic sprinkler system. *Exception 2* : Where the physical arrangement of means of egress prevents the possibility that access to both accessible means of egress will be blocked by any one fire or other emergency condition as approved by the authority having jurisdiction.
					5.5.4.3	Each required accessible means of egress shall be continuous from each accessible occupied area to a public way or area of refuge in accordance with 5.2.12.2.2.
					5.5.4.4	Where an exit stair is used in an accessible means of egress, it shall comply with 5.2.12.2.3 and either shall incorporate an area of refuge within an enlarged story-level landing or shall be accessed from an area of refuge.
					5.5.4.6	A smoke barrier that additionally has a minimum 1-hour fire resistance rating, and a horizontal exit in accordance with 5.2.4, to be considered part of an accessible means of egress, shall discharge to an area of refuge in accordance with 5.2.12.
Occupancies with high hazard contents				101B	5.11.4	Means of egress shall be arranged so that there are no dead ends in corridors. *Exception* : Spaces meeting the requirements of the Exception to 5.11.3.
Exclusions	E1	10.1.1	A lift or other similar device is not considered as an exit.	101B	5.2.8	Fire escape stairs shall not constitute any of the required means of egress.
2. Size of exits						

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
	E1	10.1.1	Passageways in an evacuation area, which leads to an exit, must be sufficiently spacious and easily passable.	101	40.2.3	Capacity of means of egress shall comply with either 40.2.3.1 or 40.2.3.2.
				101	40.2.3.1	The capacity of means of egress shall be in accordance with Section 7.3 (Code 101B Section 5.3).
				101	40.2.3.2	In industrial occupancies, means of egress shall be sized to accommodate the occupant load as determined in accordance with 40.1.7; spaces not subject to human occupancy because of the presence of machinery or equipment shall not be included in the computation.
				101	40.1.7	The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Code 101 7.3.1.2 (Code 101B 5.3.1.2) that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.
Calculation of width	E1	10.4.1	The minimum width of an exit is calculated on the basis of the number of occupants evacuating through the exit. The number of occupants of an evacuation area may be distributed between different exits and the widths of the exits are added up.	101B	5.3.1.1	The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.
				101B	5.3.1.2	The occupant load in any building or portion thereof shall be at least the number determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified:
	E1	10.4.1	The highest number of occupants intended to be present in an evacuation area shall primarily be used as the number of occupants. If several evacuation areas are connected to the same exit, the width is designed according to the evacuation area with the highest number of occupants.	101B		General and high hazard industrial: 9.3 m2 per person.
				101B		Special purpose industrial: the occupant load shall be the maximum number of persons to occupy the area under any probable conditions.
	E1	10.4.1	If the number of occupants is not known, or not otherwise used, it may be estimated on the basis of the area and use of the premises, for production and storage occupancies 30 m2/person.	101B	5.3.1.2	If both gross and net area figures are given for the same occupancy, the following calculations shall be made:
	E1	10.4.1	When a fire compartment consists of several storeys joined together by open connections, and these storeys form evacuation areas of their own, the occupants have to evacuate from different storeys simultaneously through the same exits. In these cases the adequacy of the exits is assessed also on the basis of a calculation of the evacuation time for all evacuees.			(1) Applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified
						(2) Applying the net area figure to the net area of the specific use for which the net area figure is specified.
				101B	5.3.1.2	*Exception* : In a special-purpose industrial occupancy, the occupant load shall be the maximum number of persons to occupy the area under any probable conditions.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
	E1	10.4.2	In an evacuation area where the maximum number of occupants is 60, the second exit may be 900 mm in width.	101B	5.3.1.3.1	The occupant load permitted in any building or portion thereof shall be permitted to be increased from that number established for the given use in accordance with 5.3.1.2, where all other requirements of this Code are also met, based on such increased number.
	E1	10.4.3	The total minimum width of the exits is 1200 mm for the first 120 occupants and the width is increased by 400 mm for each following group of 60 occupants.			
	E1	10.4.3	The width of an internal corridor leading to an exit is calculated in the same way as the width of the exits according to the number of occupants passing along the corridor.	101B	5.3.1.3.2	The authority having jurisdiction shall be permitted to require an approved aisle, seating, or fixed equipment diagram to substantiate any increase in occupant load and shall be permitted to require that such diagram be posted in an approved location.
	E1	10.4.3	When the fire compartment consists of several open connections between inter-related storeys, which are own exit areas, people need to egress at the same time through same passageways. Then adequacy of the exits is assesd on the basis on the total number of people to be evacuated.*	101B	5.3.1.4	Where exits serve more than one story, the occupant load of each story considered individually shall be permitted to be used in computing the capacity of the exits at that story, provided that the required egress capacity of the exit is not decreased in the direction of egress travel.
				101B	5.3.1.5	Where means of egress from stories above and below converge at an intermediate story, the capacity of the means of egress from the point of convergence shall be not less than the sum of the two.
				101B	5.3.1.6	Where any required egress capacity from a balcony or mezzanine passes through the room below, that required capacity shall be added to the required egress capacity of the room in which it is located.
				101B	5.3.3.1	Egress capacity for approved components of means of egress shall be based on the capacity factors: High-hazard contents: stairways 18 mm per person; level components and ramps 10 mm per person Other (industrial): stariways 7.6 mm per person; level components and ramps 5 mm per person
				101B	5.11.2	Egress capacity for high-hazard contents areas shall be based on 18 mm per person for stairs or 10 mm per person for level components and ramps in accordance with 5.3.3.1.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	7.3.3.2	For stairways wider than 1120 mm and subject to the 7.6 mm width per person capacity factor, the capacity shall be permitted to be increased using the following equation: $C = 146.7 + \left(\frac{Wn - 44}{0.218} \right)$ Where: *C* = capacity, in persons, rounded to nearest intergrer *Wn* = nominal width of the stairs as permitted by 7.3.2.2 (0.3 in.)
				101B	5.3.3.2	The required capacity of a corridor shall be the occupant load utilizing the corridor for exit access divided by the required number of exits to which the corridor connects, but the required capacity shall be at least that of the exit to which the corridor leads.
Minimum width and dimensions	E1	10.4.2	The width of an exit shall in general be at least 1200 mm. In an evacuation area where the maximum number of occupants is 60, the second exit may be 900 mm in width.	101B	5.3.4	The minimum width of any means of egress shall be that required by this chapter for a given egress component and shall be not less than 915 mm. *Exception 1* : The minimum width of an exit access formed by furniture and movable partitions, serving not more than six people, and not more than 15 m in length, shall be at least 455 mm at and below a height of 965 mm or 710 mm above a height of 965 mm if the minimum 915 mm width can be provided without moving permanent walls. *Exception 2* : Doors as specified for in 5.2.1.2 shall not be required to meet the minimum width requirement. *Exception 3* : Industrial equipment access walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a minimum 560 mm clear width.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
Doors				101B	5.2.1.2.3	Door openings in means of egress shall be not less than 810 mm in clear width. Where a pair of doors is provided, at least one of the doors shall provide not less than a 810 mm clear width opening. *Exception 1* : Exit access doors serving a room not larger than 6.5 m2 and not required to be accessible to persons in wheelchairs shall be not less than 610 mm in door width. *Exception 2* : Doors serving a building or portion thereof not required to be accessible to persons with severe mobility impairments shall be permitted to be 710 mm in door leaf width. *Exception 3* : A power-operated door leaf located within a two-leaf opening shall be exempt from the minimum 810 mm singleleaf requirement in accordance with Exception 2 to 5.2.1.9.1.
Stairs				101	7.2.2.2.1.2	(A) Where the total occupant load of all stories served by the stair is fewer than 50, the minimum width clear of all obstructions, except projections not more than 114 mm at or below handrail height on each side, shall be 915 mm. (B) Where stairs serve occupant loads exceeding that permitted by 7.2.2.2.1.2(A), the minimum width clear of all obstructions, except projections not more than 114 mm at or below handrail height on each side, shall be 1120 mm when total cumulative occupant load assigned to the stair is less than 2000 persons.
				101B	5.2.2.2.1	Maximum height of risers shall be 180 mm.
				101B	5.2.2.2.1	Minimum height of risers shall be 100 mm.
				101B	5.2.2.2.1	Minimum tread depth shall be 280 mm.
				101B	5.2.2.2.1	Maximum height between landings shall be 3660 mm.
				101B	5.2.2.2.1	Landing - see 5.2.1.3 and 5.2.2.3.2.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.2.2.1	*Exception* : Industrial equipment access stairs and landings that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a clear width not less than 560 mm, a tread depth not less than 255 mm, a riser height not exceeding 230 mm, a headroom not less than 2030 mm, and a height between landings not exceeding 3660 mm.
				101B	5.2.2.2.2	Curved stairs shall be permitted as a component in a means of egress where the minimum depth of tread is 280 mm at a point 305 mm from the narrower end of the tread, and the smallest radius is at least twice the stair width.
				101B	5.2.2.2.3.2	Spiral stairs shall be permitted, provided the following criteria are met: (1) Riser heights shall not exceed 180 mm. (2) The stairway shall have a tread depth of not less than 280 mm for a portion of the stairway width sufficient to provide egress capacity for the occupant load served in accordance with 5.3.3.1. (3) At the outer side of the stairway, an additional 265 mm of width shall be provided clear to the other handrail, and this width shall not be included as part of the required egress capacity. (4) Handrails complying with 5.2.2.4 shall be provided on both sides of the spiral stairway. (5) The inner handrail shall be located within 610 mm, measured horizontally, of the point where a tread depth not less than 280 mm is provided. (6) The turn of the stairway shall be such that descending users have the outer handrail at their right side.
				101B	5.2.2.2.3.3.	Where the occupant load served does not exceed three, spiral stairs shall be permitted, provided that the following criteria are met: (1) The clear width of the stairs shall be not less than 66 cm. (2) The height of risers shall not exceed 240 mm. (3) The headroom shall be not less than 1980 mm.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(4) Treads shall have a depth not less than 190 mm at a point 305 mm from the narrower edge. (5) All treads shall be identical. (6) Handrails shall be provided on both sides of the stairway.
Ramps				101B	5.2.5.2	Minimum width clear of all obstructions, except projections not more than 90 mm at or below handrail height on each side shall be 1120 mm. *Exception 1* : Industrial equipment access ramps and landings that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a minimum clear width of 560 mm and a maximum height between landings of 3660 mm.
				101B	5.2.5.2	Maximum slope shall be 1 in 12. *Exception 2* : Where not part of an accessible means of egress, ramps shall be permitted to have a slope not steeper than 1 in 8.
				101B	5.2.5.2	Maximum cross slope shall be 1 in 48.
				101B	5.2.5.2	Maximum rise for a single ramp run shall be 760 mm. *Exception 3* : Ramps that provide access to vehicles, vessels, mobile structures, and aircraft shall not be required to comply with the maximum slope or maximum rise for a single ramp run.
Exit passageways				101B	5.2.6.4	The width of an exit passageway shall be adequate to accommodate the aggregate required capacity of all exits discharging through it. *Exception* : Where an exit passageway serves occupants of the level of exit discharge as well as other stories, capacity shall not be required to be aggregated.
Industrial equipment access				101	40.2.5.3.1	Industrial equipment access doors, walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment shall be permitted in accordance with the applicable provisions of Chapter 7 (Code 101B Chapter 5), as modified:
				101	40.2.5.3.1	Minimum horizontal dimension of any walkway, landing, or platform 560 mm clear

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101	40.2.5.3.1	Minimum stair or ramp width 560 mm clear between rails
				101	40.2.5.3.1	Minimum tread width 560 mm clear
				101	40.2.5.3.1	Minimum tread depth 255 mm
				101	40.2.5.3.1	Maximum riser height 230 mm
				101	40.2.5.3.1	Handrails are permitted to terminate, at the required height, at a point directly above the top and bottom risers.
				101	40.2.5.3.1	Maximum height between landings 3660 mm
				101	40.2.5.3.1	Minimum headroom 2030 mm
				101	40.2.5.3.1	Minimum width of door openings 560 mm clear
				101	40.2.5.3.2	Any means of egress component permitted by 40.2.5.3.1 shall serve not more than 20 people.
Headroom	E1 E1	10.4.5 10.4.5	The free height of an exit shall be at least 2100 mm. There shall not be any obstacles, such as beams, pipes or lamps below the minimum height level. At the doorways the height may be reduced as required by necessary frames and thresholds.	101B	5.1.2	Means of egress shall be designed and maintained to provide headroom of not less than 2285 mm with projections of the ceiling not less than 2030 mm nominal height above finished floor. The minimum ceiling height shall be maintained for not less than two-thirds of the ceileng area of any room or space provided the remaining ceiling area is not less than 2 m. Headroom on stairs shall be minimum 2030 mm and shall be measured vertically above a plane parallel to and tangent with the most forward projection of the stair tread. *Exeption* : Industrial access walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted a headroom of not less than 2030 mm.
				101B	5.2.2.2.1	Minimum headroom in stairs shall be 2030 mm.
Measurement of width	E1	10.4.3	The width of an exit is measured horizontally and perpendicular to the direction of exit. Within the minimum width there shall be no other obstacles reducing the width than skirtings, edge beams or handrails.	101B	5.3.2	Width of means of egress shall be measured in the clear at the narrowest point of the exit component under consideration within not more than 2030 mm above the floor. *Exception* : For egress components, projections not exceeding 90 mm on each side shall be permitted at and below a height of 965 mm.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
Doors	E1	10.4.3	If there are doors in the exit in the direction of passage, the minimum free exit width of a doorway or the total free width of the doorways located next to each other may be narrowed by the total width of the necessary frames.	101B	5.2.1.2.1	In determining the egress width for swinging doors for purposes of calculating capacity, only the clear width of the doorway when the door is open 90 degrees shall be measured. In determining the egress width for other types of doors for purposes of calculating capacity, only the clear width of the doorway when the door is in the full open position shall be measured. Clear width of doorways shall be measured between the face of the door and the stop in accordance with 5.3.2.
				101B	5.2.1.2.2	For purposes of determining minimum door width, the door leaf width shall be used unless clear width is specified. Where clear width is specified, there shall be no projections into the required clear door opening width, measured in accordance with 5.2.1.2.1, lower than 865 mm above the floor or ground. Projections into the required clear door opening width that are not less than 865 mm but that do not exceed 1220 mm above the floor or ground shall be limited to the hinge side of each door opening and shall not exceed 100 mm. Projections exceeding 2030 mm above the floor or ground shall not be limited.
				101B	5.2.2.3.5	Riser height shall be measured as the vertical distance between tread nosings. Tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge, but tread depth shall not include beveled or rounded tread surfaces that slope more than 20 degrees (a slope of 1 in 2.75). At tread nosings, such beveling or rounding shall not exceed 13 mm in horizontal dimension.
3. Travel distance to exit						
Measurement of exit distance	E1	10.2.1	The distance to an exit from each point of an evacuation area is determined along the shortest passable route.	101B	5.6.2	The travel distance to an exit shall be measured on the floor or other walking surface along the centerline of the natural path of travel, starting from the most remote point subject to occupancy, curving around any corners or obstructions with a 305 mm clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. If
	E1	10.2.1	If the routes to two separate exits partly join, the length of the common part is counted to twice its length.			

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
	E1	10.2.1	If a passable route is not known beforehand, the distance is determined along a route following the direction of the walls.			measurement includes stairs, the measurement shall be taken in the plane of the tread nosing.
				101B	5.6.3	If open stairways or ramps are permitted as a path of travel to required exits, the distance shall include the travel on the stairway or ramp and the travel from the end of the stairway or ramp to an outside door or other exit in addition to the distance traveled to reach the stairway or ramp.
				101B	5.6.4	Travel distance limitations shall be as specified in Code 101 40.2.6.1 and for high-hazard areas in accordance with Code 101B Section 5.11.
				101B	5.6.5	If any part of an exterior exit is within 3050 mm horizontal distance of any unprotected building opening, as permitted in the Exceptions to 5.2.2.6.3 for outside stairs, the travel distance to the exit shall include the length of travel to ground level.
Minimum distance	E1	10.2.2	The maximum permitted distance to the nearest exit in production and storage occupancies is in general 45 m and 30 m when there is only one exit. *Exception 1* : The distances above may be exceeded, if: (1) evacuation in case of emergency is possible on a ground-level floor through windows, which can be opened. (2) the building has been provided with an automatic fire extinguishing system. *Exception 2* : Shorter maximum distances of passageways than those above may be required if an exceptional risk of rapid ignition and spread of fire due to a special use of the premises endangers safe evacuation.	101	40.2.6.1	Travel distance, measured in accordance with Section 7.6 (Code 101B section 5.6), shall not exceed:
				101	40.2.6.1	Industrial - general: unsprinkled 61 m; sprinkled 76 m (in one story buildings, a travel distance of 122 m is permitted, provided that a performance-based analysis demonstrates that safe egress can be accomplished.)
				101	40.2.6.1	Industrial - special purpose: unsprinkled 91 m; sprinkled 122 m
				101	40.2.6.1	Industrial - high hazard: unsprinkled not allowed; sprinkled 23 m.
				101	40.2.6.1	*Exception* : When permitted by 40.2.6.2.
				101	40.2.6.2	Buildings of noncombustible construction used exclusively for the enclosure of steam generators, steam turbines, gas turbines, heat recovery generators, and flue gas treatment equipment shall be permitted to have a maximum travel distance of 122 m, where all special hazards are protected by approved automatic suppression systems in accordance with one or more of the following standards, as applicable: (1) NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(2) NFPA 12, Standard on Carbon Dioxide Extinguishing Systems (3) NFPA 13, Standard for the Installation of Sprinkler Systems (4) NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection (5) NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems (6) NFPA 17, Standard for Dry Chemical Extinguishing Systems (7) NFPA 750, Standard on Water Mist Fire Protection Systems (8) NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
				101B	5.11.1	Where the contents are classified as high hazard, exits of such types and numbers shall be provided and arranged to permit all occupants to escape from the building or structure or from the hazardous area thereof to the outside or to a place of safety with a travel distance of not more than 23 m, measured as required in 5.6.2. *Exception* : A travel distance of not more than 45 m shall be permitted where flammable and combustible products are stored and protected in accordance with NFPA 30, Flammable and Combustible Liquids Code.
				101B	5.12.1	Mechanical equipment rooms, boiler rooms, furnace rooms, and similar spaces shall be arranged to limit common path of travel to not more than 15 m. *Exception* : A common path of travel not more than 30 m shall be permitted in either of the following: (1) In buildings protected throughout by an approved, supervised automatic sprinkler system. (2) In mechanical equipment rooms with no fuel-fired equipment.
4. Access to exit						
Doors				101B	5.2.1.1.2	Every door and every principal entrance that is required to serve as an exit shall be designed and constructed so that the path of egress travel is obvious and direct.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.1.4.1	Any door in a means of egress shall be of the sidehinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging from any position to the full required width of the opening in which it is installed. *Exception 1* : Security grilles as specified in 5.2.1.4.2 shall be permitted. *Exception 2* : Horizontal sliding doors that comply with 5.2.1.14 shall be permitted. *Exception 3* : Doors to private garages and business industrial and storage areas with an occupant load of not more than 10, where such garages and business industrial and storage areas contain low or ordinary-hazard contents, shall be permitted.
	E1	10.6.1	Doors located in the direction of passage in an exit shall in general open in the direction of exit.	101B	5.2.1.4.4	Doors shall swing in the direction of egress travel if used in an exit enclosure or if serving a high-hazard contents area.
	E1	10.6.2	Doors, which are necessary for exit, shall open in the direction of exit if the number of occupants evacuating through the door exceeds 60.	101B	5.2.1.4.5	During its swing, any door in a means of egress shall leave unobstructed not less than one-half of the required width of an aisle, corridor, passageway, or landing and shall not project more than 180 mm into the required width of an aisle, corridor, passageway, or landing when fully open. Doors shall not open directly onto a stair without a landing. The landing shall have a width not less than the width of the door.
	E1	10.6.2	Such doors are doors with access to the outside, to an exit or to an internal corridor leading to an exit.			
	E1	10.6.3	The doors of exits and of areas leading to the exits shall be easy to open in an emergency situation.	101B	5.2.1.4.7	The forces required to fully open any door manually in a means of egress shall not be more than 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width. Opening forces for interior side-hinged or pivotedswinging doors without closers shall not be more than 22 N. These forces shall be applied at the latch stile. *Exception* : Power-operated doors as specified in 5.2.1.9.
Self closing devices				101B	5.2.1.8.1	A door normally required to be kept closed shall not be secured in the open position at any time and shall be self-closing or automatic-closing in accordance with 5.2.1.8.2.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.1.8.2	In any building of low- or ordinary-hazard contents, or where approved by the authority having jurisdiction, doors shall be permitted to be automaticclosing, provided the following criteria are met: (1) Upon release of the hold-open mechanism, the door becomes self-closing. (2) The release device is designed so that the door instantly releases manually and upon release becomes self-closing, or the door readily closes. (3) The automatic releasing mechanism or device is activated by the operation of approved smoke detectors installed in accordance with the requirements for smoke detectors for door release service in NFPA 72, National Fire Alarm Code®. (4) Upon loss of power to the hold-open device, the holdopen mechanism is released and the door becomes selfclosing. (5) The release by means of smoke detection of one door in a stair enclosure results in the closing of all doors serving that stair.
Powered doors				101B	5.2.1.9.1	Where means of egress doors are operated by power upon the approach of a person or where doors are equipped with power-assisted manual operation, the design shall be such that, in the event of power failure, the door opens manually to allow egress travel or closes where necessary to safeguard the means of egress. The forces required to open these doors manually shall not exceed those required in 5.2.1.4.7, except that the force required to set the door in motion shall not be more than 222 N. The door shall be designed and installed so that, when a force is applied to the door on the side from which egress is made, it shall be capable of swinging from any position to the full use of required width of the opening in which it is installed. (See 5.2.1.4.) On the egress side of each door, there shall be a readily visible, durable sign that reads as follows: IN EMERGENCY, PUSH TO OPEN. The sign shall be in letters not less than 25 mm high on a contrasting background.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						Exception 1 : In an exit access that serves an occupant load of fewer than 50, sliding, power-operated doors that manually open in the direction of door travel with forces not exceeding those required in 5.2.1.4.7 shall not be required to have a swing-out feature. The required sign shall read as follows: IN EMERGENCY, PUSH TO OPEN. *Exception 2* : In the emergency break-out mode, a door leaf located within a two-leaf opening shall be exempt from the minimum 810-mm single-leaf requirement of 5.2.1.2.3 if the clear width of the single leaf is at least 760 mm. *Exception 3* : For a biparting sliding door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 810 mm single-leaf requirement of 5.2.1.2.3 if a clear opening of not less than 810 mm is provided by all leafs broken out. *Exception 4* : Doors complying with 5.2.1.14 shall be permitted to be used.
				101B	5.2.1.9.2	Where doors are required to be self-closing and (1) are operated by power upon the approach of a person or (2) are provided with power-assisted manual operation, they shall be permitted in the means of egress under the following conditions: (1) Doors can be opened manually in accordance with 5.2.1.9.1 to allow egress travel in the event of power failure. (2) New doors remain in the closed position unless actuated or opened manually. (3) When actuated, new doors remain open for not more than 30 seconds. (4) Doors are held open for any period of time close — and the power-assist mechanism ceases to function — upon operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening in accordance with the provisions of NFPA72, National Fire Alarm Code. (5) Doors required to be self-latching are either self-latching or become self-latching upon operation of approved smoke detectors per 5.2.1.9.2(4).

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(6) New power-assisted swinging doors comply with BHMA/ ANSI A156.19, American National Standard for Power Assist and Low Energy Power Operated Doors.
Horizontal sliding doors				101B	5.2.1.14.1	Horizontal sliding doors shall be permitted in means of egress under the following conditions: (1) The door is readily operable from either side without special knowledge or effort. (2) The force, applied to the operating device in the direction of egress, required to operate the door is not more than 67 N. (3) The force required to operate the door in the direction of door travel is not more than 133 N to set the door in motion and not more than 67 N to close the door or open it to the minimum required width. (4) The door is operable with a force not more than 222 N when a force of 1110 N is applied perpendicularly to the door adjacent to the operating device. (5) The door assembly complies with the fire protection rating and, where rated, is self-closing or automatic-closing by smoke detection in accordance with 5.2.1.8.
				101	40.2.2.2.5	Approved existing horizontal-sliding fire doors shall be permitted in the means of egress where they comply with all of the following conditions: (1) They are held open by fusible links. (2) The fusible links are rated at not less than 74°C. (3) The fusible links are located not more than 3050 mm above the floor. (4) The fusible links are in immediate proximity to the door opening. (5) The fusible links are not located above a ceiling. (6) The door is not credited with providing any protection under this Code.
Changes in level				101	7.1.7.1	Change in level in means of egressshall be achievedby an approved means of egress where the elevation difference exceeds 535 mm.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B (101)	5.1.4.2 (7.1.7.2)	Changes in level in means of egress not in excess of 535 mm shall be either by a ramp or by a stair that complies with the requirements of 5.2.2. The presence and location of ramped protions of walkways shall be readily apparent. The tread depth of such stair shall not be less than 330 mm and the presence and location of each step shall be readily apparent. *Exception* : Industrial access stairs that serve as a component of the means of egress from the involved equipment and do not serve more tahn 20 people shall be permitted a tread depth of not less than 24.5 cm.
Stairs				101	40.2.2.3.1	Stairs in industrial occupancies shall comply with 7.2.2 (Code 101B 5.2.2) and shall be permitted to be modified by any of the following: (1) Noncombustible grated stair treads and noncombustible grated landing floors shall be permitted. (2) Industrial equipment access stairs in accordance with 40.2.5.2 shall be permitted.
				101B	5.2.2.3.1	All stairs serving as required means of egress shall be of permanent, fixed construction.
				101B	5.2.2.3.2	Stairs shall have landings at door openings. Every landing shall have a dimension measured in the direction of travel that is at least equal to the width of the stair. (See 5.2.1.3.) Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel. *Exception* : Landings shall be permitted to be not more than 1220 mm in the direction of travel, provided the stair has a straight run.
				101B	5.2.2.3.3	Stair treads and landings shall be solid, without perforations, and free of projections or lips that could trip stair users. If not vertical, risers shall be permitted to slope under the tread at an angle of not more than 30 degrees from vertical; however, the permitted projection of the nosing shall not exceed 38 mm. *Exception* : Grated stair treads and landing floors shall be permitted in industrial occupancies.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.2.3.4	Tread slope shall not exceed a slope of 1 in 48.
				101B	5.2.2.3.6	There shall be no variation exceeding 4.8 mm in the depth of adjacent treads or in the height of adjacent risers, and the tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 9.5 mm in any flight. *Exception* : Where the bottom riser adjoins a sloping public way, walk, or driveway having an established grade and serving as a landing, a variation in height of the bottom riser not exceeding 75 mm in every 915 mm of stairway width shall be permitted.
				101B	5.2.2.6.2	Outside stairs shall be arranged to avoid any impediments to the use of the stairs by persons having a fear of high places. For stairs more than three stories in height, any arrangement intended to meet this requirement shall be no less than 1220 mm in height.
				101B	5.2.2.6.5	Outside stairs and landings shall be designed to minimize water accumulation on their surfaces.
				101B	5.2.2.6.6	Outside stairs shall be at least 50 percent open on one side and shall be arranged to restrict the accumulation of smoke.
Ramps				101	40.2.2.6	Ramps complying with any of the following shall be permitted: (1) Ramps in accordance with 7.2.5 (Code 101B 5.2.5) (2) Industrial equipment access in accordance with 40.2.5.2
				101B	5.2.5.1	Ramps shall be permitted to be used in the means of egress. Where ramps are used in the means of egress, they shall conform to the general requirements of Section 5.1 and to the special requirements of 5.2.5.
				101B	5.2.5.3.1.1	All ramps that serve as required means of egress shall be of permanent fixed construction.
				101B	5.2.5.3.1.2	Ramp floor and landings shall be solid and without perforations.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.5.3.2.1	Ramps shall have landings at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width at least the width of the ramp. Every landing shall be not less than 1525 mm long in the direction of travel.
				101B	5.2.5.3.2.2	Any changes in travel direction shall be made only at landings. Such landings shall have minimum dimensions of 1525 mm × 1525 mm.
				101B	5.2.5.3.3	Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from traveling off the edge of the ramp. Curbs or barriers shall be no less than 100 mm in height.
				101B	5.2.5.6.1	Outside ramps shall be arranged to avoid any impediments to their use by persons having a fear of high places. For ramps more than three stories in height, any arrangement intended to meet this requirement shall be no less than 1220 mm in height.
				101B	5.2.5.6.2	Outside ramps and landings shall be designed to minimize water accumulation on their surfaces.
Guards and handrails				101B	5.1.5	Guards in accordance with 5.2.2.4 shall be provided at the open sides of means of egress that are more than 760 mm above the floor or the grade below.
				101B	5.2.2.4.1	Means of egress that are more than 760mm above the floor or grade below shall be provided with guards to prevent falls over the open side. (See also 5.2.2.4.6.).
				101B	5.2.2.4.2	Stairs and ramps shall have handrails on both sides. In addition, handrails shall be provided within 760 mm of all portions of the required egress width of stairs. The required egress width shall be along the natural path of travel. (See also 5.2.2.4.5.) (See 7.2.10 for exemption to this requirement.) Exception: If part of a curb separates a sidewalk from a vehicular way, a single step or a ramp shall not be required to have a handrail.
				101B	5.2.2.4.3	Required guards and handrails shall continue for the full length of each flight of stairs. At turns of stairs, inside handrails shall be continuous between flights at landings.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.2.4.4	The design of guards and handrails and the hardware for attaching handrails to guards, balusters, or walls shall be such that there are no projections that might engage loose clothing. Openings in guards shall be designed to prevent loose clothing from becoming wedged in such openings.
				101B	5.2.5.4	Guards that comply with 5.2.2.4 shall be provided for ramps. Handrails that comply with 5.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 150 mm. The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.
Handrails					5.2.2.4.5.1	Handrails on stairs or ramps shall have a consistent height of at least 865 mm and not more than 965 mm above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the tread or the ramp walking surface. Exception 1: The height of required handrails that form part of a guard shall be permitted to be not more than 1065 mm, measured vertically to the top of the rail from the leading edge of the tread. Exception 2: Additional handrails that are lower or higher than the main handrail shall be permitted.
					5.2.2.4.5.2	Handrails shall provide a clearance of not less than 38 mm between the handrail and the wall to which it is fastened.
					5.2.2.4.5.3	Handrails shall have a circular cross section with an outside diameter of not less than 32 mm and not more than 51 mm. Exception: Any other shape with a perimeter dimension of not less than 100 mm, but not more than 160 mm, and with the largest cross-sectional dimension not more than 57 mm shall be permitted, provided that edges are rounded so as to provide a minimum radius of 3.2 mm.
					5.2.2.4.5.4	Handrails shall be continuously graspable along the entire length.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						Exception : Handrail brackets or balusters attached to the bottom surface of the handrail shall not be considered to be obstructions to graspability, provided the following criteria are met: (1) They do not project horizontally beyond the sides of the handrail within 38 mm of the bottom of the handrail and provided that, for each 13 mm of additional handrail perimeter dimension above 100 mm (4 in.), the vertical clearance dimension of 38 mm can be reduced by 3 mm. (2) They have edges with a radius of not less than 0.25 mm. (3) They obstruct not in excess of 20 percent of the handrail length if the graspable perimeter dimension is less than 140 mm.
				101B	5.2.2.4.5.5	Handrail ends shall be returned to the wall or floor or shall terminate at newel posts.
				101B	5.2.2.4.5.6	Handrails that are not continuous between flights shall extend horizontally, at the required height, not less than 305 mm beyond the top riser and continue to slope for a depth of one tread beyond the bottom riser.
Guards				101B	5.2.2.4.6.1	The height of guards required in 5.2.2.4.1 shall be measured vertically to the top of the guard from the surface adjacent thereto.
				101B	5.2.2.4.6.2	Guards shall be not less than 1065 mm high.
				101B	5.2.2.4.6.3	Open guards shall have intermediate rails or an ornamental pattern such that a sphere 100 mm in diameter shall not pass through any opening up to a height of 865 mm. *Exception* : The triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 150 mm in diameter shall not pass through the triangular opening.
Exit passageways				101B	5.2.6.1	Exit passageways shall be permitted to be used in the means of egress. Where exit passageways are used in the means of egress, they shall conform to the general requirements of Section 5.1 and to the special requirements of 5.2.6.
				101B	5.2.6.5	The floor shall be solid and without perforations.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
Impediments ot egress				101B	5.1.6	Any device or alarm installed to restrict the improper use of a means of egress shall be designed and installed so that it cannot, even in case of failure, impede or prevent emergency use of such means of egress. *Exception* : Special locking arrangements for means of egress doors as specified in 5.2.1.6
Locks and latches	E1	10.6.3	Locks, which can be double-bolted without a key in such a way that they cannot be opened from the inside without a key, shall not in general to be used in doors of exits and in doors of areas leading to exits.	101B	5.2.1.5.1	Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side of the building.
	E1	10.6.3	Locks, which during the normal use of the premises can be opened from the inside without a key in an emergency, are used in production and storage occupancies.	101B	5.2.1.5.5	A latch or other fastening device on a door shall be provided with a releasing device that has an obvious method of operation and that is readily operated under all lighting conditions. The releasing mechanism for any latch shall be located not less than 865 mm and not more than 1220 mm above the finished floor. Doors shall be openable with not more than one releasing operation.
				101B	5.2.1.5.6	Where pairs of doors are required in a means of egress, each leaf of the pair shall be provided with its own releasing device. Devices that depend on the release of one door before the other shall not be used.
				101B	5.2.1.5.7	Devices shall not be installed in connection with any door on which panic hardware or fire exit hardware is required if such device prevents or is intended to prevent the free use of the door for purposes of egress.
				101B	5.2.1.6.1	In industrial occupancies approved, listed, delayed egress locks shall be permitted to be installed on doors serving low- and ordinaryhazard contents in buildings protected throughout by an approved, supervised automatic fire detection system or an approved, supervised automatic sprinkler system, provided the criteria in (A) through (D) are met.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(A) The doors shall unlock upon actuation of an approved, supervised automatic sprinkler system, or upon the actuation of any heat detector or activation of not more than two smoke detectors of an approved, supervised automatic fire detection system. (B) The doors shall unlock upon loss of power controlling the lock or locking mechanism. (C) An irreversible process shall release the lock within 15 seconds upon activation of a force to the release device required in 5.2.1.5.5. The force to initiate the lock-releasing process shall not have to be applied continuously for more than 3 seconds. The force applied to initiate the lock-releasing process shall not have to exceed 67 N. The initiation of the release process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only. (D) On the door adjacent to the release device, there shall be a readily visible, durable sign in letters not less than 25 mm high and not less than 3.2 mm in stroke width on a contrasting background that reads as follows: PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 SECONDS.
	E1	10.6.3	The arrangements for access control must not prevent safe exit from a building.	101B	5.2.1.6.2	In industrial occupancies doors in the means of egress shall be permitted to be equipped with an approved entrance and egress access control system, provided the following criteria are met: (1) A sensor, arranged to detect an occupant approaching the doors, shall be provided on the egress side, and the doors shall be arranged to unlock in the direction of egress upon detection of an approaching occupant or loss of power to the sensor. (2) Loss of power to that part of the access control system that locks the doors shall automatically unlock the doors in the direction of egress.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(3) The doors shall be arranged to unlock in the direction of egress from a manual release device located 1015 mm to 1220 mm vertically above the floor and within 1525 mm of the secured doors. The manual release device shall be readily accessible and clearly identified by a sign that reads as follows: PUSH TO EXIT. When operated, the manual release device shall result in direct interruption of power to the lock — independent of the access control system electronics — and the doors shall remain unlocked for at least 30 seconds. (4) Activation of the building fire-protective signaling system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset. (5) Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.
				101B	5.11.5	Doors that serve high-hazard contents areas with occupant loads of more than five shall be permitted to be provided with a latch or lock only if it is panic hardware or fire exit hardware that complies with 5.2.1.7.
Panic and fire exit hardware				101B	5.2.1.7.1	In any occupancy any door serving high-hazard contents area with an occupant load of 5 or more persons shall be equipped with panic or fire exit hardware. Such a releasing device shall meet the following criteria: (1) It shall consist of cross bars or push pads, the actuating portion of which extends across not less than one-half of the width of the door leaf and not less than 865 mm nor more than 1220 mm above the floor. (2) It shall be constructed so that a horizontal force not exceeding 67 N actuates the cross bar or push pad and latches.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.1.7.2	Only approved panic hardware shall be used on doors that are not fire doors. Only approved fire exit hardware shall be used on fire doors.
				101B	5.2.1.7.3	Required panic hardware and fire exit hardware shall not be equipped with any locking device, set screw, or other arrangement that prevents the release of the latch when pressure is applied to the releasing device. Devices that hold the latch in the retracted position shall be prohibited on fire exit hardware. *Exception* : Listed and approved devices that hold the latch in the retracted position shall be permitted on fire exit hardware.
Walking surfaces				101B	5.1.3.2	Abrubt changes in elevation shall not exceed 6.3 mm. Changes in elevation exceeding 6.3 mm but not exceeding 13 mm shall be beleved 1 to 2. Changes in elevation exceeding 13 mm shall be considered a change in level and shall be subject to the requirements of 5.1.5.
				101B	5.1.3.3	Walking surfaces shall be nominally level. The slope of walking surface in the direction of travel shall not exceed 1 in 20 unless the ramp requirements of 5.2.5 are met. The slope perpendicular to the direction of travel shall not exceed 1 in 48.
				101B	5.1.3.4	Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.
				101B	5.2.1.3	The elevation of the floor surfaces on both sides of a door shall not vary by more than 13 mm. The elevation shall be maintained on both sides of the doorway for a distance not less than the width of the widest leaf. Thresholds at doorways shall not exceed 13 mm in height. Raised thresholds and floor level changes in excess of 6.3 mm at doorways shall be beveled with a slope not steeper than 1 in 2.
Furnishing in means of egress	E1	10.5.5	Materials, building elements or facilities which increase the fire load or which endanger life safety through their smoke production must not be placed in exits.	101	7.1.10.2.1	No furnishings, decorations, or other objects shall obstruct exits or their access thereto, egress therefrom, or visibility thereof.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
egress					7.1.10.2.2	No obstruction by railings, barriers, or gates shall divide the means of egress into sections appurtenant to individual rooms, apartments, or other occupied spaces.
5. Separation of exits						
	E1	10.5.1	An exit is in general considered as a fire compartment of its own.			
	E1	10.5.2	The exits in maximum 24 m high buildings of class P1 with maximum 8 stories shall be at least fire-separated.	101B (101)	5.1.1.2.1 (7.1.3.2.1)	Where an exit is required to be separated from other parts of the building, exits shall meet following requirements:
			The exits in higher than 24 m high buildings of class P1 with maximum 16 stories shall be at least fire-proof.	101B (101)	5.1.1.2.1 (7.1.3.2.1)	(A) Separation shall have not less than 1-hour fire resistance rating when connecting 3 stories or less. Opening protectives shall have not less than 1-hour fire protection rating.
				(101)	(7.1.3.2.1)	(2) The separation specified in 7.1.3.2.1(1) (Code 101B 5.1.1.2.1(A)) shall be supported by construction having not less than a 1-hour fire resistance rating.
				(101)	(7.1.3.2.1)	(6) Structural elements, or portions thereof, that support exit components and either penetrate into a fire resistance–rated assembly or are installed within a fire resistance–rated wall assembly shall be protected, as a minimum, to the fire resistance rating required by 7.1.3.2.1(1) (Code 101B 5.1.1.2.1.(A)).
				(101B)	(5.1.1.2.1)	(C) Openings therein shall be protected by fire door assemblies equipped with door closers complying with 5.2.1.8.
				(101B)	(5.1.1.2.1)	(D) Openings in exit enclosures shall be limited to those necessary to access the enclosure from normally occupied spaces and corridors for egress from the enclosure.
				(101B)	(5.1.1.2.1)	(E) Penetrations into and openings throughan exit enclosure assembly shall be prohibited except for electrical conduit serving the stairway, required exit doors, ductwork and equipment necessary for indipendentstair pressuration, water or steam piping necessary for the heating or cooling of the exit enclosure, sprinkler piping and standpipes.
				(101B)	(5.1.1.2.1)	(F) Penetrations or communication openings shall be prohibited between adjecent exit enclosures.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				(101)	(7.1.3.2.1)	(12) Membrane penetrations shall be permitted on the exit access side of the exit enclosure and shall be protected in accordance with 8.3.5.6.
					5.5.1.10.2	Ancillary facilities in special-purpose industrial occupancies where delayed evacuation is anticipated shall have no less than a 2-hour fire resistance–rated separation from the predominant industrial occupancy and shall have one means of egress that is separated from the predominant industrial occupancy by 2-hour fire resistance–rated construction.
Stairs	E1	10.1.1	Passageways leading to an exit may include stairs between different levels only if the levels can be considered to belong to the same evacuation area.	101B	5.2.2.5.1	All inside stairs serving as an exit or exit component shall be enclosed in accordance with 5.1.1.2.
	E1	10.5.3	The flights of stairs and landings shall meet the requirements of class R 30 when the fire load of the rooms leading to the exit is less than 600 MJ/m2. The corresponding requirement is R 60, when the fire load is higher than that. (P1 ja P2 luokka)	101B	5.2.2.5.2	Where nonrated walls or unprotected openings enclose the exterior of a stairway and the walls or openings are exposed by other parts of the building at an angle of not more than 180 degrees, the building enclosure walls within 3050 mm horizontally of the nonrated wall or unprotected opening shall be constructed as required for stairway enclosures, including opening protectives. Construction shall extend vertically from the ground to a point 3050 mm above the topmost landing of the stairs or to the roofline, whichever is lower.
	E1	10.5.3	The flights of stairs and landings of an exit in buildings of class P1 with more than two storeys shall be made of building materials at least of class A2–s1, d0.			
	E1	10.5.4	The required protective cladding K2 30, A2-s1, d0 can be replaced by a construction that will protect structures behind it from ignition, charring or other damage (EI 30, A2-s1, d0 - class materials).*			*Exception* : The fire resistance rating of the separation extending 3050 mm from the stairs shall not be required to be more than 1 hour with openings having a 3⁄4-hour fire resistance rating.
					5.2.2.5.3	There shall be no enclosed, usable space within an exit enclosure, including under stairs, nor shall any open space within the enclosure be used for any purpose that has the potential to interfere with egress. *Exception* : Enclosed usable space shall be permitted under stairs if the space is separated from the stair enclosure by the same fire resistance as the exit enclosure. Entrance to such enclosed usable space shall not be from within the stair enclosure. (See also 5.1.1.2.3.)

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
Outside stairs				101B	5.2.2.6.3	Outside stairs shall be separated from the interior of the building by walls with the fire resistance rating required for enclosed stairs with fixed or self-closing opening protectives. This construction shall extend vertically from the ground to a point 3050 mm above the topmost landing of the stairs or to the roofline, whichever is lower, and no less than 3050 mm horizontally. *Exception 1* : Outside stairs serving an exterior exit access balcony that has two remote outside stairways or ramps shall be permitted to be unprotected. *Exception 2* : Outside stairs serving not more than two adjacent stories, including the story of exit discharge, shall be permitted to be unprotected where there is a remotely located second exit. *Exception 3* : The fire resistance rating of the separation extending 3050 mmfrom the stairs shall not be required to be more than 1 hour with openings having a 3⁄4-hour fire protection rating.
				101B	5.2.2.6.4	All openings below an outside stair shall be protected with an assembly having a 3⁄4-hour fire protection rating under one of the following conditions: (1) Where located in a court, the smallest dimension of which is not more than one-third its height. (2) Where located in an alcove having a width not exceeding one-third its height and a depth exceeding one-fourth its height.
Ramps				101B	5.2.5.5	Ramps in a required means of egress shall be enclosed or protected as a stair in accordance with 5.2.2.5 and 5.2.2.6. The use of Exception 2 to 5.2.2.6.3 shall be prohibited.
Exit passageways					5.2.6.2	An exit passageway shall be separated from other parts of the building as specified in 5.1.1.2. Exception: Fire windows shall be permitted to be installed in such a separation in a building protected throughout by an approved, supervised automatic sprinkler system.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
					5.2.6.3	An exit passageway that serves as a discharge from a stair enclosure shall have not less than the same fire resistance rating and opening protective fire protection rating as those required for the stair enclosure.
Smoke proof enclosures				101B	5.2.3.1	Smokeproof enclosures shall be permitted to be used in the means of egress. Where smokeproof enclosures are used in the means of egress, they shall conform to the general requirements of Section 5.1, the special requirements of 5.2.3, and the building code.
					5.2.3.2	A smokeproof enclosure shall be enclosed from the highest point to the lowest point by barriers that have 2-hour fire resistance ratings. Where a vestibule is used, it shall be within the 2-hour rated enclosure and shall be considered part of the smokeproof enclosure.
					5.2.3.3	Where a vestibule is provided, the doorway into the vestibule shall be protected with an approved fire door assembly that has a 1½-hour fire protection rating, and the fire door assembly from the vestibule to the smokeproof enclosure shall have at least a 20-minute fire protection rating. Doors shall be designed to minimize air leakage and shall be self-closing or shall be automatic-closing by actuation of a smoke detector within 3050 mm of the vestibule door.
					5.2.3.4	Every smokeproof enclosure shall discharge into a public way, into a yard or court having direct access to a public way, or into an exit passageway. Such exit passageways shall be without openings other than the entrance from the smokeproof enclosure and the door to the outside yard, court, or public way. The exit passageway shall be separated from the remainder of the building by a 2-hour fire resistance rating.
Ventilation	E1	10.4.2	When a passageway becomes narrower the staircase shall be equipped with a smoke vent which can be triggered from the entrance level of the staircase or by an automatic smoke	101	7.2.3.7	Smokeproof enclosures using natural ventilation shall comply with Code 101B 5.2.3.2 and all of the following:

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
			ejector.*			(1) Where access to the enclosure is by means of an open exterior balcony, the door assembly to the enclosure shall have a minimum 11⁄2-hour fire protection rating and shall be self-closing or shall be automatic-closing by actuation of a smoke detector. (2) Openings adjacent to the exterior balcony specified in 7.2.3.7(1) shall be protected in accordance with Code 101B 5.2.2.6.4. (3) Every vestibule shall have a net area of not less than 1.5 m2 of opening in an exterior wall facing an exterior court, yard, or public space not less than 6100 mm in width. (4) Every vestibule shall have a minimum dimension of not less than the required width of the corridor leading to it and a dimension of not less than 1830 mm in the direction of travel.
				101	7.2.3.8	Smokeproof enclosures using mechanical ventilation shall comply with 7.2.3.3 and the requirements of 7.2.3.8.1 through 7.2.3.8.4.
				101	7.2.3.8.1	Vestibules shall have a dimension of not less than 1120 mm in width and not less than 1830 mm in the direction of travel.
				101	7.2.3.8.2	The vestibule shall be provided with not less than one air change per minute, and the exhaust shall be 150 percent of the supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate tightly constructed ducts used only for such purposes. Supply air shall enter the vestibule within 150 mm of the floor level. The top of the exhaust register shall be located not more than 150 mm below the top of the trap and shall be entirely within the smoke trap area. Door leaves, when in the open position, shall not obstruct duct openings. Controlling dampers shall be permitted in duct openings if needed to meet the design requirements.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101	7.2.3.8.3	To serve as a smoke and heat trap and to provide an upward-moving air column, the vestibule ceiling shall be not less than 510 mm higher than the door opening into the vestibule. The height shall be permitted to be decreased where justified by engineering design and field testing.
				101	7.2.3.8.4	The stair shall be provided with a dampered relief opening at the top and supplied mechanically with sufficient air to discharge at least 70.8 m3/min through the relief opening while maintaining a positive pressure of not less than 25 N/m2 in the stair, relative to the vestibule with all door leaves closed.
				101	7.2.3.9.1	Smokeproof enclosures using pressurization shall use an approved engineered system with a design pressure difference across the barrier of not less than 12.5 N/m2 in sprinklered buildings, or 25 N/m2 in nonsprinklered buildings, and shall be capable of maintaining these pressure differences under likely conditions of stack effect or wind. The pressure difference across door openings shall not exceed that which allows the door leaves to begin to be opened by a force of 133 N in accordance with Code 101B 5.2.1.4.7.
				101	7.2.3.9.2	Equipment and ductwork for pressurization shall be located in accordance with one of the following specifications: (1) Exterior to the building and directly connected to the enclosure by ductwork enclosed in noncombustible construction (2) Within the enclosure with intake and exhaust air vented directly to the outside or through ductwork enclosed by a 2-hour fire-resistive rating (3) Within the building under the following conditions: (a) Where the equipment and ductwork are separated from the remainder of the building, including other mechanical equipment, by a 2-hour fire-resistive rating

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(b) Where the building, including the enclosure, is protected throughout by an approved, supervised automatic sprinkler system, and the equipment and ductwork are separated from the remainder of the building, including other mechanical equipment, by not less than a 1-hour fire-resistive rating
				101	7.2.3.9.3	In all cases specified by 7.2.3.9.2(1) through (3), openings into the required fire resistance–rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire protection-rated devices in accordance with 8.3.4.
				101	7.2.3.10.1	For both mechanical ventilation and pressurized enclosure systems, the activation of the systems shall be initiated by a smoke detector installed in an approved location within 3050 mm of each entrance to the smokeproof enclosure.
				101	7.2.3.10.2	The required mechanical system shall operate upon the activation of the smoke detectors specified in 7.2.3.10.1 and by manual controls accessible to the fire department. The required system also shall be initiated by the following, if provided: (1) Waterflow signal from a complete automatic sprinkler system (2) General evacuation alarm signal
Door leaf closers				101	7.2.3.11	The activation of an automatic closing device on any door leaf in the smokeproof enclosure shall activate all other automatic-closing devices on door leaves in the smokeproof enclosure.
Emergency power system				101	7.2.3.12	Power shall be provided as follows: (1) A Type 60, Class 2, Level 2 EPSS for new mechanical ventilation equipment shall be provided in accordance with NFPA 110, Standard for Emergency and Standby Power Systems. (2) A previously approved existing standby power generator installation with a fuel supply adequate to operate the equipment for 2 hours shall be permitted in lieu of 7.2.3.12(1).

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(3) The generator shall be located in a room separated from the remainder of the building by fire barriers having a minimum 1-hour fire resistance rating.
Testing				101	7.2.3.13	Before the mechanical equipment is accepted by the authority having jurisdiction, it shall be tested to confirm that it is operating in compliance with the requirements of 7.2.3 (Code 101B Section 5.2.3). All operating parts of the system shall be tested semiannually by approved personnel, and a log shall be kept of the results.
Exclusion				101B	5.1.1.1.8	There shall be no requirements for exit access corridor wall construction.
6. Exit marking						
	E1	10.6.4	Premises, from which evacuation may otherwise be difficult, shall be provided with exit signs.*	101B	5.10.1.1	Means of egress shall be marked in accordance with this section for every building and structure except Special purpose industrial occupancies without routine occupancy, or daylight operations with windows.
	E1	10.6.4	Ministry of Interior has given a regulation on building escape route marking and lighting (805/2005).*			
	E1	10.6.5	If the doors of exits and the access to them are not clearly visible or if other doors may confuse the evacuees, the exits and the access to them shall be marked, where required.	101B	5.10.1.2	Exits, other than main exterior exit doors that obviously and clearly are identifiable as exits, shall be marked by an approved sign readily visible from any direction of exit access.
				101B	5.10.1.3	Tactile signage shall be located at each door into an exit stair enclosure, and such signage shall read as follows: EXIT. Signage shall comply with ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities, and shall be installed adjacent to the latch side of the door 152 cm above the finished floor to the centerline of the sign.
				101B	5.10.1.4	Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants. Sign placement shall be such that no point in an exit access corridor exceeds the rated viewing distance or 30 m, whichever is less, from the nearest sign.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.10.1.7	Every sign required in Section 5.10 shall be located and of such size, distinctive color, and design that it is readily visible and shall provide contrast with decorations, interior finish, or other signs. No decorations, furnishings, or equipment that impairs visibility of a sign shall be permitted. No brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision of the required exit sign that could detract attention from the exit sign shall be permitted.
				101B	5.10.2	A sign complying with 5.10.3 with a directional indicator showing the direction of travel shall be placed in every location where the direction of travel to reach the nearest exit is not apparent.
				101B	5.10.3	Signs required by 5.10.1 and 5.10.2 shall have the word EXIT or other appropriate wording in plainly legible letters. *Exception* : Where approved by the authority having jurisdiction, pictograms shall be permitted.
				101B	5.10.4	Where emergency lighting facilities are required by 5.9.1.1, the signs, other than approved selfluminous signs and listed photoluminescent signs in accordance with 5.10.7.2, shall be illuminated by the emergency lighting facilities. The level of illumination of the signs shall be in accordance with 5.10.6.3 or 5.10.7 for the required emergency lighting duration as specified in 5.9.2.1. However, the level of illumination shall be permitted to decline to 60 percent at the end of the emergency lighting duration.
				101B	5.10.5.1	Every sign required by 5.10.1.2 or 5.10.1.4, other than where operations or processes require low lighting levels, shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be legible in both the normal and emergency lighting mode.
				101B	5.10.5.2	Every sign required to be illuminated by 5.10.6.3 and 5.10.7 shall be continuously illuminated as required under the provisions of Section 5.8.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						Exception : Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.
				101B	5.10.6.1	Externally illuminated signs required by 5.10.1 and 5.10.2 shall have the word EXIT or other appropriate wording in plainly legible letters not less than 150 mm high, with the principal strokes of letters not less than 19 mm wide. The word EXIT shall have letters of a width not less than 5 cm, except the letter I, and the minimum spacing between letters shall be not less than 9.5 mm. Signs larger than the minimum established in this paragraph shall have letter widths, strokes, and spacing in proportion to their height.
				101B	5.10.6.2	*Exception 1* : This requirement shall not apply to marking required by 5.10.1.3 and 5.10.1.5. *Exception 2* : Where approved by the authority having jurisdiction, pictograms shall be permitted. The directional indicator shall be located outside of the EXIT legend, not less than 9.5 mm from any letter. The directional indicator shall be of a chevron type, as shown in Figure 5.10.6.2. The directional indicator shall be identifiable as a directional indicator at a distance of 12m. A directional indicator larger than the minimum established in this paragraph shall be proportionately increased in height, width, and stroke. The directional indicator shall be located at the end of the sign for the direction indicated.

FIGURE 5.10.6.2 Chevron-Type Indicator.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.10.6.3	Externally illuminated signs shall be illuminated by not less than 54 lux at the illuminated surface and shall have a contrast ratio of not less than 0.5.
				101B	5.10.7.1	Internally illuminated signs shall be listed in accordance with UL 924, Standard for Safety Emergency Lighting and Power Equipment. *Exception* : This requirement shall not apply to signs that are in accordance with 5.10.1.3 and 5.10.1.6.
				101B	5.10.7.2	The face of a photoluminescent sign shall be continually illuminated while the building is occupied. The illumination levels on the face of the photoluminescent sign shall be in accordance with its listing. The charging illumination shall be a reliable light source as determined by the authority having jurisdiction. The charging light source shall be of a type specified in the product markings.
				101B	7.10.8.2	Special signs, where required by other provisions of this Code, shall comply with the visual character requirements of ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
				101B	5.10.8.1	Any door, passage, or stairway that is neither an exit nor a way of exit access and that is located or arranged so that it is likely to be mistaken for an exit shall be identified by a sign that reads as follows: NO EXIT. Such sign shall have the word NO in letters 5 cm high with a stroke width of 9.5 mm and the word EXIT in letters 2.5 cm high, with the word EXIT below the word NO.
Stairs				101	7.2.2.5.4.1	New enclosed stairs serving three or more stories shall comply with 7.2.2.5.4.1(A) through 7.2.2.5.4.1(O). (A) The stairs shall be provided with special signage within the enclosure at each floor landing. (B) The signage shall indicate the floor level. (C) The signage shall indicate the terminus of the top and bottom of the stair enclosure. (D) The signage shall indicate the identification of the stair enclosure. (E) The signage shall indicate the floor level of, and the direction to, exit discharge.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(F) The signage shall be located inside the stair enclosure. (G) The bottom of the signage shall be located a minimum of 1220 mm above the floor landing, and the top of the signage shall be located a maximum of 84 in. (2135 mm) above the floor landing. (H) The signage shall be in a position that is visible when the door is in the open or closed position. (I) The signage shall comply with 7.10.8.1 (Code 101B 5.10.5) and 7.10.8.2 of this Code. (J) The floor level designation shall also be tactile in accordance with ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities. (K) The signage shall be painted or stenciled on the wall or on a separate sign securely attached to the wall. (L) The stairway identification shall be located at the top of the sign in minimum 25 mm high lettering and shall be in accordance with 7.10.8.2. (M) Signage that reads NO ROOF ACCESS shall designate stairways that do not provide roof access. Lettering shall be a minimum of 1 in. (25 mm) high and shall be in accordance with 7.10.8.2. (N) The floor level number shall be located below the stairway identifier in minimum 125 mm high numbers and shall be in accordance with 7.10.8.2. Mezzanine levels shall have the letter “M” or other appropriate identification letter preceding the floor number, while basement levels shall have the letter “B” or other appropriate identification letter preceding the floor level number. (O) Identification of the lower and upper terminus of the stairway shall be on the sign in minimum 25 mm high letters or numbers and shall be in accordance with 7.10.8.2.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.2.2.5.5	Where an enclosed stair requires travel in an upward direction to reach the level of exit discharge, signs with directional indicators that indicate the direction to the level of exit discharge shall be provided at each floor level landing from which upward direction of travel is required. Such signage shall be readily visible when the door is in the open or closed position. *Exception 1* : Where signs required by Code 101 7.2.2.5.4 are provided. *Exception 2* : Stairs that extend not more than one story below the level of exit discharge where the exit discharge is clearly obvious.
				101	7.2.2.5.4.3	Where new contrasting marking is applied to stair treads, such marking shall comply with all of the following: (1) The marking shall include a continuous strip as a coating on, or as a material integral with, the full width of the leading edge of each tread. (2) The marking shall include a continuous strip as a coating on, or as a material integral with, the full width of the leading edge of each landing nosing. (3) The marking strip width, measured horizontally from the leading vertical edge of the nosing, shall be consistent at all nosings. (4) The marking strip width shall be 25 mm to 51 mm.
				101	7.2.2.5.4.4	Where new contrast marking is provided for stairway handrails, it shall be applied to, or be part of, at least the upper surface of the handrail; have a minimum width of 13 mm; and extend the full length of each handrail. After marking, the handrail shall comply with Code 101B 5.2.2.4.5. Where handrails or handrail extensions bend or turn corners, the stripe shall be permitted to have a gap of not more than 100 mm.
7. Exit illumination						
	E1	10.6.4	Premises, from which evacuation may otherwise be difficult, shall be provided with emergency or exit lighting or both.	101B	5.8.1.1	Illumination of means of egress shall be provided in accordance with this section for every building and structure. For the purposes of this requirement, exit access shall include

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
	E1	10.6.4	Ministry of Interior has given a regulation on building escape route marking and lighting (805/2005).*			only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways, and exit passageways leading to a public way.
				101B	5.8.1.2	Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time asrequired to maintain the illumination to the minimum criteriavalues herein specified. *Exception* : Automatic, motion sensor–type lighting switches shall be permitted within the means of egress, provided that switch controllers are equipped for fail-safe operation, illumination timers are set for no less than a 15-minute duration, and the motion sensor is activated by any occupant movement in the area served by the lighting units.
				101B	5.8.1.3	The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 5.8.1.1 shall be illuminated to values of not less than 10.8 lux measured at the floor.
				101	7.8.1.3	(1) During conditions of stair use, the minimum illumination of new stairs shall be at least 108 lux, measured at the walking surfaces.
				101B	5.8.1.4	Required illumination shall be arranged so that the failure of any single lighting unit will not result in an illumination level in any designated area of less than 2.2 lux.
				101B	5.8.1.5	The equipment or units installed to meet the requirements of Section 5.10 shall be permitted also to serve the function of illumination of means of egress, provided that all requirements of Section 5.8 for such illumination are met.
				101B	5.8.2.1	Illumination of means of egress shall be from a source considered reliable by the authority having jurisdiction.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.8.2.2	Battery-operated electric lights and other types of portable lamps or lanterns shall not be used for primary illumination of means of egress. Battery-operated electric lights shall be permitted to be used as an emergency source to the extent permitted by Section 5.9.
				101B	5.9.1.1	Emergency lighting facilities for means of egress shall be provided in accordance with this section for the following: (1) Industrial occupancies exept special purpose without routine occupancy, or daylight operations with windows. (3) High-rise buildings. (4) At doors equipped with delayed egress locks.
				101B	5.9.1.2	For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways that lead to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, ramps, aisles, walkways, and escalators that lead to a public way.
				101B	5.9.1.3	Where maintenance of illumination depends on changing from one energy source to another, a delay of not more than 10 seconds shall be permitted.
				101B	5.9.2.1	Emergency illumination shall be provided for a period of 1⁄2 hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 10.8 lux and a minimum at any point of 1.1 lux, measured along the path of egress at floor level. Illumination levels shall be permitted to decline to an average of 6.5 lux and a minimum at any point of 0.65 lux at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
				101B	5.9.2.2	The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting, such as any failure of a public utility or other outside electrical power supply; the opening of a circuit breaker or fuse; or any manual act(s), including accidental opening of a switch controlling normal lighting facilities.
				101B	5.9.2.3	Emergency generators that provide power to emergency lighting systems shall be installed in accordance with NFPA 110, Standard for Emergency and Standby Power Systems. Stored electrical energy systems, where required in this Code, shall be installed in accordance with NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems.
				101B	5.9.2.4	Battery-operated emergency lights shall use only reliable types of rechargeable batteries provided with suitable facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with NFPA 70, National Electrical Code.
				101B	5.9.2.5	The emergency lighting system either shall be continuously in operation or shall be capable of repeated automatic operation without manual intervention.
				101B	5.9.3	High-rise buildings shall be provided with Class 1, Type 60 standby power in accordance with NFPA 70, National Electrical Code, and NFPA 110, Standard for Emergency and Standby Power Systems. The standby power system shall have a capacity and rating sufficient to supply all required equipment. Selective load pickup and load shedding shall be permitted in accordance with NFPA 70. The standby power system shall be connected to the following: (1) Emergency lighting system. (2) At least one elevator serving all floors and transferable to any elevator. (Note! Elevators excluded from this comparison.)

Area	RakMK section	RakMK paragraph	RakMK rule	NFPA code	NFPA paragraph	NFPA rule
						(3) Mechanical equipment for smokeproof enclosures.

* Free translation

8.3.4 Opening Protectives

8.3.4.1

Every opening in a fire barrier shall be protected to limit the spread of fire and restrict the movement of smoke from one side of the fire barrier to the other.

8.3.4.2

The fire protection rating for opening protectives in fire barriers, fire-rated smoke barriers, and fire-rated smoke partitions shall be in accordance with Table 8.3.4.2, except as otherwise permitted in 8.3.4.3 or 8.3.4.4.

8.3.4.2.1

Fire-rated glazing assemblies marked as complying with hose stream requirements (H) shall be permitted in applications that do not require compliance with hose stream requirements. Fire-rated glazing assemblies marked as complying with temperature rise requirements (T) shall be permitted in applications that do not require compliance with temperature rise requirements. Fire-rated glazing assemblies marked with ratings that exceed the ratings required by this Code (XXX) shall be permitted.

8.3.4.3 Existing fire door assemblies having a minimum 3⁄4-hour fire protection rating shall be permitted to continue to be used in vertical openings and in exit enclosures in lieu of the minimum 1-hour fire protection rating required by Table 8.3.4.2.

8.3.4.4 Where a 20-minute fire protection–rated door is required in existing buildings, an existing 13⁄4 in. (44 mm) solidbonded wood-core door, an existing steel-clad (tin-clad) wood door, or an existing solid-core steel door with positive latch and closer shall be permitted, unless otherwise specified by Chapters 11 through 43.

8.3.5.6 Membrane penetrations

8.3.5.6.1 Membrane penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents and exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a membrane of a wall, floor, or floor/ceiling assembly constructed as a fire barrier shall be protected by a firestop system or device and shall comply with 8.3.5.1 through 8.3.5.5.2.

8.3.5.6.2 The firestop system or device shall be tested in accordance with ASTM E 814, Standard Test Method for Fire Tests of Through Penetration Fire Stops, or ANSI/UL 1479, Standard for Fire Tests of Through-Penetration Firestops, at a minimum positive pressure differential of 2.5 N/m2 between the exposed and the unexposed surface of the test assembly, unless one of the following applies:
(1) Membrane penetrations of ceilings that are not an integral part of a fire resistance–rated floor/ceiling or roof/ceiling assembly shall be permitted.

(2) Membrane penetrations of steel, ferrous, or copper conduits, and pipes, tubes, or combustion vents or exhaust vents, shall be permitted where the annular space is protected with an approved material and the aggregate area of the openings does not exceed 0.06 m2 in any 9.3 m2 of ceiling area.
(3) Electrical outlet boxes and fittings shall be permitted, provided that such devices are listed for use in fire resistance–rated assemblies and are installed in accordance with their listing.
(4) The annular space created by the membrane penetration of a fire sprinkler shall be permitted, provided that the space is covered by a metal escutcheon plate.

8.3.5.6.3 Where walls or partitions are required to have a minimum 1-hour fire resistance rating, recessed fixtures shall be installed in the wall or partition in such a manner that the required fire resistance is not reduced, unless one of the following is met:

(1) Any steel electrical box not exceeding 0.01 m2 shall be permitted where the aggregate area of the openings provided for the boxes does not exceed 0.06 m2 in any 9.3 m2 of wall area, and, where outlet boxes are installed on opposite sides of the wall, the boxes shall be separated by one of the following:
(a) Horizontal distance of not less than 610 mm
(b) Horizontal distance of not less than the depth of the wall cavity, where the wall cavity is filled with cellulose loose-fill, rock wool, or slag wool insulation.
(c) Solid fireblocking
(d) Other listed materials and methods
(2) Membrane penetrations for any listed electrical outlet box made of any material shall be permitted, provided that such boxes have been tested for use in fire resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
(3) The annular space created by the membrane penetration of a fire sprinkler shall be permitted, provided that the space is covered by a metal escutcheon plate.
(4) Membrane penetrations by electrical boxes of any size or type, which have been listed as part of a wall opening protective material system for use in fire resistance–rated assemblies and are installed in accordance with the instructions included in the listing, shall be permitted.

11.7 Turvallisuusselvitys

Safety assessment

11.7.1

Henkilöturvallisuuden kannalta vaativiin kohteisiin, joissa paloturvallisuuden riskit johtuvat tilojen käyt-tötavasta ja henkilöiden rajoitetusta tai alentuneesta toimintakyvystä, tulee suunnittelun alkuvaiheessa laatia erityinen turvallisuusselvitys. Tämän pohjalta määritetään rakenteelliset ja muut toimenpiteet riittävän turvallisuustason saavuttamiseksi. Turvallisuusselvitys laaditaan yhteistyössä kohteen suunnittelijoi-den ja käyttäjien, turvallisuudesta vastaavien viranomaisten sekä muiden tarpeellisten tahojen kanssa.

Edellä tarkoitettuja kohteita ovat mm. hoitolaitokset sekä sellaiset majoitustilat ja asunnot, jotka on tarkoitettu hen-kilöille, joiden poistumismahdollisuudet alentuneen toi-mintakyvyn seurauksena ovat tavanomaista huonommat.

Tulipalotilanteessa kriittisiä toimintakykyyn vaikuttavia tekijöitä ovat havainto-, ymmärrys- ja liikkumiskyky.

Pääsuunnittelija on vastuussa siitä, että suunnittelussa tar-vittavat lähtötiedot ovat käytettävissä.

Turvallisuusselvityksen laatimiseksi tarvitaan kohteen turvallisuuteen liittyvät tiedot eri osapuolilta. Toiminnan harjoittaja määrittelee toiminnan luonteen ja käytettävissä olevat resurssit. Pääsuunnittelija määrittelee rakennukseen liittyvät asiat. Pelastuslaitos antaa tiedot toimintavalmiudesta.

For building works which are demanding from the point of life safety and where the risks for fire safety depend on the use of the premises and the restricted or reduced capabilities of the occupants, a particular safety assessment shall be worked out at an early stage of the design work. The structural and other means, which are necessary for reaching a sufficient level of safety, are based on this assessment. The safety assessment is prepared through cooperation between the designers and users of the building work, the authorities responsible for safety issues and other necessary parties.

Building works intended above are e.g. institutions and such accommodation premises and dwellings, which are intended for occupants whose evacuation capabilities are inferior than normally, due to their reduced capabilities.

Critical factors affecting the capabilities in fire situations are perceptive, comprehensive and locomotion faculty.

The principal designer is responsible for the availability of source information necessary for the design work.

For preparation of the safety assessment, safety related information is needed from all parties concerned. The parties managing the works define the nature of the activities and the available resources. The principal designer defines matters relating to the building. The rescue department provides information on the readiness of action.