Regulations for bunkering LNG
CCNR round table LNG, 13-11-2012

Erik Büthker,
chairman of Dutch standards committee LNG refuelling stations
Content

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What is a standard, the role of standards

Dutch standard on LNG refuelling stations, PGS 33 part 1

LNG bunkering for ships, PGS 33 part 2

International standards development

Conclusion
Projecten van Ballast Nedam
Subsidiaries of Ballast Nedam

Clean fuel

CNG Net
What is a standard

- Standards voluntary in application documents
- Established by all interested parties
- Reflects consensus
The role of standards

To overcome International trade barriers
  – refuelling coupling car/filling station
  – pressure levels for LNG storage

International certification of components and systems
  – clear specifications and test methods
  – no trade barriers caused by local regulations

International accepted safety level
  – minimal safety requirements
  – safety distances at LNG refuelling station

Standards are necessary to introduce a “new” fuel to get market acceptance
  – clear specifications and test methods
  – no trade barriers caused by local regulations
International standards development

- UN ECE
  - R49
  - R110
  - R83
- CEN
  - TC 282 LNG
  - TC 326 gas for NGV
  - EN 1160
  - EN 1473
  - EN 13645 LNG refueling station
  - prEN 13638 CNG refuelling station
  - prEN 13945 VRA
- ISO
  - TC 58
  - SC 3
    - LNG cyl.
    - ISO 11439
  - SC 4
    - LNG cyl.
    - ISO 19078
    - ISO 14469
  - TC 193
  - TC22/SC25
  - Draft CNG meter approval testing
  - LNG dispenser meter approval testing
- OIML
  - TC8/SC7
  - WG 1
  - WG 2
  - WG 3
  - ISO 15500
  - ISO 15501
  - LNG veh. inst.
  - LNG Comp
  - LNG and CNG veh. Workshop & parking
  - LNG refueling connector

Discipline naam
International versus national standards

ISO

ISO/TC 252

ISO/TC 252 WG 2

LNG

NC 310 326

NEN

PGS Beheersorganisatie

PGS Programmaraad

PGS - teams 25 & 33

PGS 25

PGS 33

Internationaal

Nationaal

NWIPs

Programmeerdaad

ISO-standard
PGS is a Dutch national guideline that gives an interpretation of legislation into practice. It describes the state of the art, written into:

- rules
- recommendations
- criteria
- conditions

Covering

- Safety on the job
- Environment safety
- Transport safety
- Fire safety
PGS 33 part 1 LNG truck refuelling
Scope PGS 33 part 1 in detail

Land based installations for LNG road transport

Land based to ship bunkering of LNG will be covered by part two of PGS 33

Floating LNG refuelling stations (bunker barges) not covered by PGS 33, Possible a NPR

LNG Road Transport of is covered by ADR

LCNG is covered
Content of the standard

General construction and design

Operational requirements
- maintenance, periodic inspections
- procedures for filling the storage

Certification
- Atex, PED

Internal safety distances

External safety distances

Safety precautions
Internal safety distances

- Purpose: prevention of occupational & fire hazards (avoid domino effects)
- Within frameworks of OHS- and Fire safety regulations
- To be protected: installations, workers and visitors
- Fit to practical criteria, e.g. engineering basic principles
- Based on credible incident scenarios

Credible scenario

a: ~ 1-2 mm leak valve
   10 g/s LNG
b: Ignition
c: Jet fire
d: Heat radiation flux

Max 37.5 kW/m² to protected installation
Internal safety distances

- Scenario 1,2, a leak of 10 g LNG/s
- Scenario 3 flow of LNG out of a refuelling hose
- Scenario 4 extreme impact
External safety distances

Purpose:
Prevention of major incidents + land use planning within framework of external safety regulations Based on risk approach (probability x consequence) + risk standards

To be protected:
persons in the environment of establishment
iso risk contours based on harmonised risk calculations methods (QRA, SAFETI-NL)
Discipline naam

Bunkering options

MARITIME TRAFFIC
HbR/DHMR
CB, v1.6

PGS 33-1
Truck
Tanking

PGS 33-2
Shore - (Inland) Vessel
STS during sailing

PGS 33-3
STSS Short-Sea

PGS 33-3
Tank Truck - Vessel

PGS 33-3
STSS Short-Sea
PGS 33 part 2 LNG bunkering for ships
Existing European standards

Off shore

On shore

CEN

EN 1160 general characteristics and properties of materials in contact with LNG
EN 1473 design of Onshore LNG installation > 200 tonnes
EN 146201 storage tanks for liquefied gasses
EN 12308 testing of gaskets for flanged joints on LNG piping

CEN

EN 1474 design and testing of marine transfer systems, part 1 design and testing, part 2 hoses, part 3 offshore transfer system
EN 1532 Ship to shore interface
Existing mondial standards

Off shore

ISO TC 67 WG 10
Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industry
PT1 Systems and installations for supply of LNG as fuel to ships including refueling connector
PT4 Properties of equipment in contact with LNG

On shore

ISO TC 67 WG 10
PT3 Safety and risk assessment for onshore LNG plants (terminals)
PT5 Onshore LNG storage tanks

Ship to ship

ISO TC 67 WG 10
PT2 Ship to shore interface (carrier to terminal)
PT6 LNG transfer system
ISO 28460 Ship-to-Shore interface and port operations

Ship to shore
## PGS33 vs ISO 16924 LNG refuelling stations for trucks

<table>
<thead>
<tr>
<th>Design, construction and maintenance</th>
<th></th>
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<tbody>
<tr>
<td>PGS 33</td>
<td>ISO 16924: —</td>
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<tr>
<td><strong>Operation:</strong></td>
<td></td>
</tr>
<tr>
<td>- No boil off</td>
<td>• -----</td>
</tr>
<tr>
<td>- -----</td>
<td>• Refuelling pressure</td>
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<tr>
<td>- ----</td>
<td>• Dispenser metering</td>
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<tr>
<td><strong>Safety</strong></td>
<td></td>
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<tr>
<td>- PED</td>
<td>• Minimal safety requirements</td>
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<tr>
<td>- ATEX</td>
<td>E.g. Pressure relief valve, break away coupling, emergency stop</td>
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<tr>
<td>- Safety distances</td>
<td></td>
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<tr>
<td><strong>Inspection &amp; documentation</strong></td>
<td></td>
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<tr>
<td>- Complete installation</td>
<td>• Component level</td>
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</tbody>
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Conclusion

PGS 33 guideline for LNG filling stations final about end 2012

Internal safety distances: very small;
Defining external safety distances follows separated but parallel procedure;

Lack of experience and knowledge of authorities with LNG; training is required

Knowledge transfer on standards for bunkering, CCNR could be a platform

Sailing on LNG will be realistic
  – technical, economical, environmental
  – regulations needed for transport of LNG as cargo over water
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