Aalto-yliopisto
Insinööritieteiden
korkeakoulu

EEN-E4004 Fundamentals of HVAC Design

Lecture 27.3.2019

Water and Sewage design

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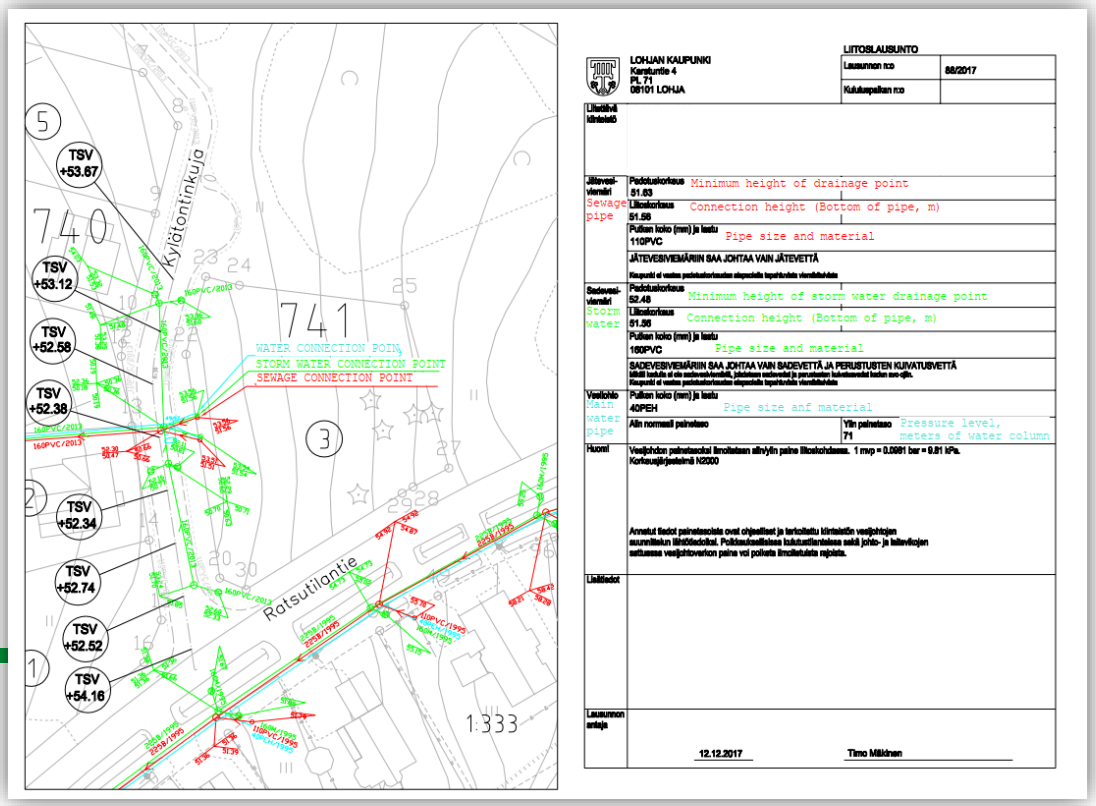
Water and sewage design

- Connection point statement
  - Connection points
  - Minumun heigth of drainage point against backwater (for sewage and stormwater)
  - Water pressure level in connection point
- Site plan / Outside installations
  - External drainage
  - Stormwater dimensioning
  - Main water pipe
  - Gullys
    - PVK, RK, JVTK/SVTK, TP
- Fixtures (domestic water and sewer)
  - Examples
- Domestic water
  - Nominal flows, measuring flow
  - Pressure level
  - Pipe sizes (velocity, pressure drop)
  - Installation methods, parts, materials
  - Hot water circulation
  - Insulation
- Sewage
  - Nominal flows, measuring flow
  - Materials, parts
  - Sewer ventilation, access covers, installation methods.
  - Insulation

Connection point statement

- Given by local waterworks company or city (f.ex HSY)
- Location of connection points
- Connection sizes and heights
- Minumum height of drainage device
- Water pressure at connection point



Site plan / Outside installations

- **Main water pipe**
  - Material usually plastic (PE)
  - Under building, installation in protecting pipe (replaceability)

- **Sewage pipes outside**
  - At least one inspection gully needed between building and connection point
  - First inspection gully must be located right outside building wall
  - Installation under frost depth or insulation and defreezing cable
  - Measuring according calculation from builidings sewage points
  - Usually DN110 in one-family houses
  - The pipe size must not be reduced in the flow direction
  - Gully (JVTK = jätevesi tarkastuskaivo = sewer inspection gully)
    - See examples

Site plan / Outside installations

- **Stormwater**
  - Measuring flow = Area*k*0,015 l/s/m2 (0,010…0,020 l/s)

    k_n valumiskerroin osa-alueella, <- Flow coefficient

    k = 1,0, Hard surfaces: roofs, tarmac, concrete etc.

    k = 0,7, Gravel surfaces

    k = 0,3, Lawn and other soft surfaces
  - Pipe material usually plastic
  - Pipe size (D1, appendix 7, picture 2)
  - Sewers installed under ground DN75 is minimum.
  - The pipe size must not be reduced in the flow direction
  - Underdrainage connection usually through non-return valve
  - Gullys (PVK, RK, SVTK, TP)
    - See examples

Water and sewage fixtures

- **Examples for domestic water fixtures**
  - Toilet seat
    - Ido Glow 60
    - CW connection nominal flow = 0,1 l/s, pressure drop 150 kPa
    - Sewage connection DN110, nominal flow 1,8 l/s
  - Basin + tap
    - Oras Safira tap
    - Ido Glow 60 wash basin
  - Shower
    - Oras Optima
  - Kitchen sink + tap
    - Oras Optima
    - Franke sink
  - Technical room sink + tap
    - Kavika sink
    - Oras tap
  - Floor drains
    - Vieser, Purus etc.
  - Water post
    - Oras, etc.

Domestic water systems

- **Domestic water pipe materials**
  - Copper (soldering, compression couplers)
  - Plastic (PEH, PEX) (welding, compression couplers)
  - Composite (compression couplers)
  - *Stainless steel, AISI 304 (big sizes* ≤DN65) (welding, flange)

- **Dimensioning water pipes by D1 (Appendix 2)**
  - Nominal flows (Table 1)
    - Basin 0,1 l/s, Sink 0,2 l/s, Shower 0,2 l/s, Bath tub 0,3 l/s
  - Dimensioning flow (Table 2)
  - Pipe sizes (Table 4 and 5)
  - PEX connection pipes from manifold 15mm
  - Velocity circa ≤ 1,5…2 m/s
  - Pressure in connection pipe near tap should be circa 200 kPa to reach the nominal flow (minimum 70%). Pressure needed after water meter is normally 300…400 kPa, pressure reduction valve in case when pressure is too high.
  - dP of main water pipe (~10 kPa), dP of water meter (~25 kPa)

Domestic water systems

- **Hot water circulation (Appendix 2)**
  - Hot water waiting time max. 20s
  - Hot water minimun temperature 55 °C
  - Hot water circulation pipe velocity 0,5 m/s (max 1,0 m/s)
  - Heat loss from hot water pipes ca. 10 W/m
  - Connecting space heaters or floor heating is forbidden.

- **Pipe insulations**
  - According to LVI-card (LVI 50-10345)
  - Vapor proof surcafe for cold water pipe insulations
  - Visble connection pipes without insulation
  - Plastic connection pipes (15M) installed in protecting pipe without insulation
  - Sewer isulated against freezing.
  - Sewer vent pipe insulated in cold attics

Sewage systems

- **Sewage pipe materials**
  - Commonly used Plastic, PP (with rubber ring joint)
  - Under ground PP or PVC (rubber ring joint)
  - *Stainless steel, cast iron, copper, PE,*

- **Dimensioning sewage pipes by D1 (Appendix 4)**
  - Nominal flows, NF (Table 1)
    - Basin 0,3 l/s, Sink 0,6 l/s, Shower to galley 0,6 l/s, Toilet 1,8 l/s
  - Dimensioning flow (Picture 1)
  - Sewer size and minimum fall (Picture 3 for plastic)
  - Minimum sewer connection size for toilet is DN100
  - The pipe size must not be reduced in the flow direction
  - At least one sewer ventilation pipe must be taken above roof
  - Sewage ventilation pipe size $\sum NF \leq 5$ l/s DN70, otherwise DN100 (Table 4)

Sewage systems

- **Sewer design (Appendix 4)**
  - Sewer must be equipped with needed access covers (see D1, Table 3)
    - In the bottom of every vertical risers (min. 400mm from floor)
    - Every 20 meters in horizontal lines
  - Washing machine and dish washer can be drained trough other sewer point water trap.
  - Dry galley in sauna can be drained in other galley with water trap

- **Sewer insulations**
  - Sewer insulated against freezing. Electric defreezing cable when neccesary
    - When installed above frost depth
    - When installed in subfloor space
    - When installed outiside
    - Sewer vent pipe insulated in cold attics
  - Acoustic insulation in critical spaces (and/or spesific dB-sewer)
  - Storm water drainage pipes needs condensate insulation if installed indoors.

Water and sewage design

- **For backround information**
  - Talotekniikkainfo.fi
  - Building code collection, part D1 (https://www.finlex.fi/data/normit/28208-D1_2007.pdf)