# Plastic Pipe Systems for Cold, Hot and Heating Water Installations

**Service Parameters – Division by “S”, “SDR” and “PN”**

The plastic pipes have standardized outer diameter and wall thickness. Pipes of identical material with different wall thickness have different service parameters (service pressure / service temperature / service life). The pipes were divided into pressure series designated “PN” according to wall thickness originally. As the plastic material properties gradually improved, the PN designation relevance, particularly as far as the hot water systems are concerned, was increasingly lower and the individual series were named S or SDR.

* **PN** (pressure nominal): service pressure value at which the equipment can be operated at 20 °C temperature and with 50 years’ service life.
* **S = (SDR-1)/2; SDR** equals approximately to **D/t** where D is outer pipe diameter and t is pipe wall thickness.

**For example, PE pipes for water supply and for drainage and sewerage under pressure** are still designated S, SDR and PN in the applicable standard (ČSN EN 12201-2):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Pipe series** | | | | | |
|  | SDR 6  S2.5 | SDR 7.4  S 3.2 | SDR 9  S4 | SDR 11  S5 | SDR 13,6  S 6.3 | SDR 17  S8 |
|  | Nominal pressure (bar) | | | | | |
| PE 40 | - | PN 10 | PN 8 | - | PN 5 | PN 4 |
| PE 63 | - | - | - | PN 10 | PN 8 | - |
| PE 80 | PN 25 | PN 20 | PN 16 | PN 12.5 | PN 10 | PN 8 |
| PE 100 | - | PN 25 | PN 20 | PN 16 | PN 12.5 | PN 10 |

ČSN EN 12201 standard provides also a definition of PN: The value corresponds to permissible working overpressure (PFA) of water supplied at 20 °C, expressed in bars, for the minimum design coefficient. The table shows PN values for specific S series pipes (i.e. pipes with same wall thickness) differing depending on polyethylene (PE) type. The PN value as an information regarding hydrostatic strengths of the pipes at 20 °C service temperature, is relevant for PE pipes in cold water installations unlike in **hot and cold water installations**. This application is subject to standards for various materials:

* ČSN EN ISO 15874 Plastics piping systems for hot and cold water installations - Polypropylene (PP)
* ČSN EN ISO 15875 Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X)
* ČSN EN ISO 15876 Plastics piping systems for hot and cold water installations - Polybutylene (PB)
* ČSN EN ISO 15877 Plastics piping systems for hot and cold water installations - Chlorinated poly(vinyl chloride) (PVC-C)
* ČSN EN ISO 22391 Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT)

The standards above do not use the PN designation. S series are defined for pipes. For example, polypropylene pipes designated PN 10 formerly are now assigned with SS designation in the standard. (Both values are used typically by the manufacturers considering the classic division using PN continues to be kept in mind by the customers.) German DIN 8077/1997 standard contained the following general table for PN, S and SDR conversion covering thee polypropylene types (PP-H, PP-B, PP‑R) for a transition period:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PN | 10 | 16 | 20 | 25 |
| S | 5 | 3.2 | 2.5 | 2.0 |
| SDR | 11 | 7.4 | 6 | 5 |

PP-RCT (type 4) polypropylene type featuring improved pressure resistance, in particular at high temperatures, was placed in the market recently. This material has been incorporated also in ČSN EN ISO 15874 and DIN 8077 standards where new S pipe series (S8, S6.3, S4) have also been added solely for the PP-RCT type. The pipes of this material cannot be designated with PN; since the PN values are no longer specified in the standard, the new S series are not assigned with corresponding PN values. A part of the Table Pipe Dimensions in ČSN EN ISO 15874-2 is provided below – as the wall thickness increases the “S” value decreases (see definition of S).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Outer diameter (mm) | **Pipe series** | | | | | | |
| S8 | S6.3 | S5 | S4 | S3.2 | S2.5 | S2 |
| Wall thickness | | | | | | |
| 25 | 1.8 | 1.9 | 2.3 | 2.8 | 3.5 | 4.2 | 5.1 |
| 32 | 1.9 | 2.4 | 2.9 | 3.6 | 4.4 | 5.4 | 6.5 |
| 40 | 2.4 | 3.0 | 3.7 | 4.5 | 5.5 | 6.7 | 8.1 |

S8, S6.3 and S4 series apply only to PP-RCT.

The new polypropylene type offers improved pressure resistance, in particular at high temperatures (60 °C and more), which is an important factor for hot and heating water installations. The pipes of this material can be used at higher temperatures and pressures and allow using lower wall thickness than in case of PP-R (type 3) polypropylene pipes.

Comparison of pressure resistance of PP-R and PP-RCT pipes with the same “S” (same wall thickness)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **PP-R**  **S 3.2 SDR 7.4** | **PP-RCT**  **S 3.2 SDR 7.4** |
| Temperature [ºC] | Service life [y] | Service pressure [bar] | |
| **60 ºC** | 50 | 10.2 | 12.8 |
| **70 ºC** | 50 | 6.7 | 10.7 |
| **80 ºC** | 25 | 5.1 | 9.1 |

Comparison of pressure resistance of PP-R and PP-RCT pipes with different “S“ – Even if PP-RCT pipes have lower wall thickness, their pressure resistance is higher than that of PP-R pipes:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **PP-R**  **S 3.2 SDR 7.4** | **PP-RCT** S 4 SDR 9 |
| Temperature [ºC] | Service life [y] | **Service pressure [bar]** | |
| **60 ºC** | 50 | 10.2 | 10.2 |
| **70 ºC** | 50 | 6.7 | 8.5 |
| **80 ºC** | 25 | 5.1 | 7.2 |

**How can a user know for which application is a pipe designed?**

The manufacturer is obliged to provide information, which indicates the intended application, on each pipe in the following format: **application class / service pressure**.

ISO 10508 standard defines typical application classes:

* **Class 1** (supply of 60 °C hot water, 50 years’ service life)
* **Class 2** (supply of 70 °C hot water, 50 years’ service life)
* **Class 4** (underfloor heating, low-temperature radiators, 50 years’ service life of which (in aggregate for the service life) 20 years at 40 °C service temperature, 25 years at 60 °C service temperature and 2.5 years at 70 °C service temperature]
* **Class 5** (high-temperature radiators, 50 years’ service life of which (in aggregate for the service life) 14 years at 20 °C service temperature, 25 years at 60 °C service temperature, 10 years at 80 °C service temperature and 1 year at 90 °C service temperature)

For each material and S series, maximum service temperature (4, 6, 8, 10 bar) for the respective application class is determined based on calculation.

**Example: PP-RCT pipe – S 3,2, information on pipe in the following format:**

Class 1/10bar, 2/10bar, 4/10bar, 5/8bar indicates that the pipe is intended for use:

in 60 °C hot water installations with 10 bar service pressure and 50 years’ service life (class 1/10);

in 70 °C hot water installations with 10 bar service pressure and 50 years’ service life (class 2/10);

in underfloor heating systems and low-temperature radiators with 10 bar service pressure and 50 years’ service life (class 4/10);

in low-temperature radiators with 8 bar service pressure and 50 years’ service life (class 5/8).

The same designation system is used for pipes of other materials – see the list of standards at the beginning of the article.



*description of the pipe*