Plumbing Standards for Auroville

Auroville Water Service

In collaboration

with

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INDEX

1. Executive Summary 3
2. Introduction 4
3. Plumbing material and its usage 5
   3.1. Recommended brands and suppliers 6
       3.1.1. HDPE 6
       3.1.2. PP 7
       3.1.3. cPVC 8
       3.1.4. uPVC 8
   3.2. Pressure test for the pipes: a MUST for the entire network, external and internal! 8
   3.3. Water meters 10
       3.3.1. Water Meter Brand 10
4. Fire safety Rules and regulations as per National Building Code of India 11
5. Technical Details and Designs, “Everything MUST Fit Together” 11
   5.1. Further information’s for project holders:
       5.1.1. Water Line minimum pipe Sizing - Internal plumbing 12
       5.2. Knots and valve system 13
6. Critical Implementation - Points and Remarks 14
8. Bibliography 15
1. **Executive Summary**

The present responsibility for the plumbing (external and internal) of Auroville projects lies with the project holders. Most of the time, the material choice and its type of installation are chosen on the economical side rather than on the best possible material and quality standards. By this method, the long term safety and maintenance issues are ignored and problems are left afterwards to the residents which are buying these apartments etc.

But not only the plumbing material is important to assure a safe and trouble free long life supply, it’s the entire internal network design of the building which needs to be studied right at the start of the project.

In the Residential Zone e.g. the main supply network provides app. 15 to 18 m head pressure by the elephant tank. **If the provided pressure is sufficient** for the building up to the last floor **needs to be verified by the project holder**.

In other words, the entire piping system of larger and multiple floor buildings must designed and verified by professional engineers and not by local plumbers.

In case the available pressure is not sufficient, NBC of India clearly states that the project holder has to build his own storage tank along with the booster system.

After all, the success can only be guaranteed if all parties work and follow same standards and principles.

The following booklet gives an overview of the minimum required plumbing standards. These plumbing standards have been carefully developed by Auroville Water Service in collaboration with Aqua Engineers and are based on the National Building Code of India and international Norms.

Auroville Water Service
2. **Introduction**

The existing pipes in Auroville are of inferior quality. The network as such has grown naturally, and it has not been planned in a scientific or technical way. The pipes are made most of the time of low-quality PVC.

![Image](https://example.com/image1.png)

*Image 1: Low quality PVC pipe damaged by a Neem tree root*

Furthermore, the PVC pipes which have been laid within the area contain chemical-carcinogenic substances such as softeners and plasticizers. These types of pipes are forbidden by WHO for food and drinking water applications.

Meanwhile the market offers economical good alternatives to the old fashion PVC pipes.

These are:

- HDPE  High Density Polyethylene Pipes
- cPVC  Chlorinated Polyvinyl Chloride
- uPVC  unplastizide Polyvinyl Chloride
- PP:    Polypropylene
- SS:    Stainless Steel

In the following document, the authors give an overview of the usage and right choice of the material.
3. **Plumbing material and its usage**

**HDPE grade 100 (short PE 100):**
- Lifetime up to 100 years
- Suitable for food and drinking water supply according to WHO
- Pipe length up to 200 m (coils) without join
- Suitable for cold water up to 60° C
- Material can be welded
- High resistance against high amounts of acid and alkalinity
- Difficult for internal plumbing
- Sensitive against Chlorine and UV-radiation

**PP:**
- Lifetime of up to 100 years
- Suitable for hot water up to 120° C
- Material can be welded
- Material and fittings are not as common as HDPE

**cPVC:**
- Lifetime of up to 100 years
- Suitable for hot water up to 90° C
- High resistance against mechanical use
- High resistance against high amounts of acid or alkaline
- Only glue type is available

**uPVC or PVCu:**
- Lifetime of up to 100 years
- Suitable for cold water up to 60° C
- High resistance against mechanical use
- High resistance against high amounts of acid or alkaline
- Only glue type is available

**SS:**
- Lifetime of up to 50 years
- Suitable for cold water up to 40° C
- High resistance against mechanical use
- Used for high pressure applications
- High resistance against high amounts of acid or alkaline
- Joints can be made with treads or by gas welding
- Material is sensitive against temperature change
3.1. **Recommended brands and suppliers**

3.1.1. **HDPE**

It is very important that the material is sourced only from reliable companies. There are many duplicates on the market and especially with HDPE, the risk to get a bad quality pipe is very high.

The specifications for the HDPE pipe must fulfill the following criteria:

- **Norm:** ISO 4427, design stress of 8 MPa
- **Raw material:** imported ready mixed raw material (Certificate necessary)

**Recommended suppliers and brands for HDPE:**

- Georg Fischer Piping Systems
- Duraline India
- Aliaxis group /Friatec
- UPI
3.1.2. PP

PP is not (yet) used in Auroville:

- Norm: ISO 15495, ISO 15874
- Raw material: imported ready mixed raw material (Certificate necessary)

**Recommended suppliers and brands for PP:**

- Georg Fischer Piping Systems
- Duraline India
- Aliaxis group /Friatec
3.1.3. cPVC

This material should be used for hot water pipes inside the building.

- Norm: ISO 15493, ISO 15877 and ASTM-D-1785
- Glue: heavy duty glue of same brand

**Recommended suppliers and brands cPVC:**

- Georg Fischer Piping Systems
- Finolex India
- Astral India
- Supreme

3.1.4. uPVC

This material should be used for cold water pipes inside the building.

- Norm: ISO 15493, ASTM-D-1785
- Glue: heavy duty glue of same brand

**Recommended suppliers and brands cPVC:**

- Georg Fischer Piping Systems
- Finolex India
- Astral India
- Supreme

3.2. **Pressure test for the pipes: a MUST for the entire network, external and internal!**

In general, a pressure test is a way in which pressure vessels such as pipelines, plumbing, gas cylinders, boilers and fuel tanks can be tested for strength and leaks. The test involves filling the vessel or pipe system with a liquid, usually water, which may be dyed to aid visual leak detection, and then applying the specified test pressure to the vessel.

Pressure tightness can be tested by shutting off the supply valve and observing whether there is a loss of pressure. The location of a leak can be visually identified more easily if the water contains a colorant. Strength is usually tested by measuring permanent deformation of the container.
A pressure test must be made for external main pipes as well as for the internal house pipes.

Image 2: Pressure testing equipment

The recommendation is to apply approximately 6 to 8 bar pressure on the pipelines and keep the pressure for at least two hours.

Procedure:

1) Install a valve at the inlet of the houses
2) Install a pressure gauge in one of the bathroom taps
3) Interlink hot water pipe with a connection tube
4) Fill the pipe with water and use the pump to achieve the require testing pressure
5) Make sure that the air is released before final pressure check
6) Close the main valve and disconnect the pump
7) Take a reading of the pressure gauges and make a note
8) Inspect the pipe and its joints
9) Wait for 12 hours and take another reading; note it down
10) There should be 0 difference in the readings, otherwise there is a leak somewhere

IMPORTANT! Make sure that all adaptors, valves, temp, nipples, etc. are properly closed so that any leakage from them can be excluded.
3.3. **Water meters**

Many Water meters have been installed at each connection/junction point to the different communities/apartment blocks or houses. The connection from the main HDPE pipeline can be made in the following way:

Image 3: Connection from [GF and FR]

It is a must that for each apartment, meters need to be installed. The main reasons are:

+ Determination of water consumption of the individuals
+ Help in reduction of the water consumption as the user is been made aware of his/her consumption
+ Helps to identify leaks
+ A fair billing system is assured as people which are “consciously users” pay in the end less than the ones which “do not care”

3.3.1. **Water Meter Brand**

The water meters should fulfill the following standards:

- Norm: ISO 4064-1:2014,
- Accuracy: Class 2
- Size as per flow specification

**Recommended suppliers and brands for Water meters:**

- Aquamet & Zenner
- A pre-filter may be necessary in some applications
4. **Fire safety Rules and regulations as per National Building Code of India**

The fire safety standards do not fall directly under the plumbing standards, but since the latest fire, which occurred in May 20018 in Auromodele has shown a clear need for firefighting equipment along with the necessary availability of water.

NBC regulates that each building must have a certain provision for firefighting. The type of equipment depends on the building category.


Further, Auroville has to follow the legal standards to avoid any kind of risk to its residents. Disregarding these laws is illegal and may result in the loss of lives.

NBC 2005 covers only fire standards for buildings, hence the grid pattern of hydrants for the Residential area was chosen to be app. 150 m.

Hydrants should be located at least every 1000 m in mains and every 300 – 400 m in distribution pipes (DVGW W 400-1) [2].

**DVGW proposes that hydrants are positioned every 100 m in shopping areas, every 120 m in densely populated residential areas and every 140 m in less populated residential areas** [2].

As per DW 2012, hydrants have been placed within the Residential Zone in regular distances.

5. **Technical Details and Designs. “Ever yt hing MUST Fit Toget her”**

The technical items have been selected with the aim that everything must fit together. The main problem is that technical choices and recommended materials often create difficulties for the designer and plumbers because they simply do not fit together. Most of the time, the materials used do not meet the standards and simply do not fit together. In many cases, plumbers use their own “tricks” to solve the issues, which results in leaks at a later stage 99% of the time.

Therefore, the aim of this standard is that the entire piping network (internal and external) should be built out of a reliable material e.g. HDPE, with all required fittings, valves, joints, etc. that fit together and are of a reliability guaranteed to last for more than 50 years.
5.1. **Further information’s for project holders:**

1. The project holder has to apply for a water connection to AWS.
2. This application must have detailed information about the users, the building type and height.
3. AWS then will prepare a document of common understanding, which the project holder has to agree upon before a connection is granted.
4. The plumbing standard is part of the agreement and the project holder has to agree upon the connection.
5. The size for a single connection is limited for the time being by 75 mm.
6. All external pipes have to be made in HDPE with electro fusion joints. The material and brands must be as per chapter 3.1.1
7. The welding of the HDPE pipes must be done with from the supplier recommended tools and welding machines.
8. The welding ends of the HDPE pipe must be peeled with tools which are recommended by the suppliers. The tools must be sharp and a clamp recommended by the supplier has to be used.
9. The peeled end needs to be cleaned with 100% alcohol or special cleaning liquid which is provided e.g. by Georg Fischer. Not allowed is the usage of thinner, petrol, diesel or any other liquid.
10. Welding is allowed only by trained personal with certificate from the suppliers end or which are issued by Aqua Engineers.
11. The internal plumbing must be made with pipes as per chap. 3.1.3 and 3.1.4
12. A pressure test needs to be made as per chap. 3.2
13. Each Single unit or house has to Installed separate water meter minimum size 1” or 32 mm The water meters must have a isolation valve and pre filter.
14. The quality of the meter must be as per chap. 3.3
15. The internal plumbing network shall be designed by a hydraulic engineer and not by local plumber or architect.
16. In case the pressure is insufficient, the project holder has to incorporate a sump and booster system on his own costs.
17. In no way, AWS can be held responsible for insufficient pressure at the last floor.
5.2. Knots and valve system

Image 4: Ball valve HDPE/PP [GF]

These valves are welded directly into the main line with a simple EF coupling. Further, the complications that may occur, e.g. with a flange based joint and valve, are eliminated. There are no metal parts built in which might cause corrosion problems later. These valves do not require any servicing at a later stage.

Image 5: Operation telescopic spindle (adjustable model), operation key, street covers, [GF]
6. **Critical Implementation - Points and Remarks**

The laying of the new pipe and its connection to the existing network needs special attention. The main anticipated difficulties may be summarized as follows:

1. Digging => one does not know what one finds: damage, etc.
2. Existing water supply should not be interrupted for more than 4 hours.
3. Joining the old pipes to the new: rotten PVC pipes can be expected => changing entire lengths of pipes might be necessary.
4. Working in the residential Zone is limited at present to the pressure of the Elephant Tank.
   Therefore, the project holder has first evaluate and calculate if the available pressure of the main line is sufficient for his project or if a booster system is required.
5. Further, the connection capacity from the main line in residential zone is limited to the max. available saddles and connection pipe dia. It is possible that larger projects require more than one connection to obtain the necessary flow and pressure.

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