

**PRACTICAL  
SOLUTIONS TO  
WATER  
HAMMER**

*Revised Edition*

1800 - HAMMER  
1800 - 426 637

**COPPER**

*Copper Development Centre. Australia Ltd*

## **PREFACE**

Since the first “Water Hammer Booklet” was launched in July 1998, many calls have been received from plumbers, engineers and builders on water hammer noise.

In helping to resolve these problems there has been an increased understanding of the causes of water hammer in its many forms, in both metallic and non-metallic systems.

Version 2 of this booklet has been released to share this knowledge with the Plumbing Industry.

The installation of air chambers and the reduction of water pressure below 500 kPa (as per AS/NZS 3500 requirements) was found to eliminate water hammer noise in virtually all instances.

This book is issued as a tool to assist in the design and installation of copper piping systems. In the event problems are experienced, do not hesitate to contact the Water Hammer Help Line on 1800 – HAMMER (1800-426 637)

John Fennell  
Chief Executive Officer  
Copper Development Centre Australia Limited

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## 1. INTRODUCTION

The following water hammer information was developed by the Copper Development Centre Australia Limited, with technical support from Allan Archie and John Williamson. Copper Tube member companies Crane Copper Tube and MM Kembla support the work, which offers solutions to what are in general isolated cases of water hammer that often would have been avoided if consideration had been given to the system design and pressures at the planning stage.

Some homes are subjected to water hammer in plumbing of both metallic and plastic pipes. A great deal of damage occurs, not only to the pipes themselves, but also to expensive appliances, tapware and fittings.

To prevent potential damage, the shock waves related to water hammer need to be eliminated.

- **SHOCK WAVES** will impose undesirable stress on piping and appliances unless controlled and can exist with or without noise.
- **NOISE** which is auditory, alerts property owners to water hammer problems. Without the noise there will be no indication of a problem until damage is caused, or worse, a home is flooded by a burst appliance hose, pipe or fitting.
- **COPPER PLUMBING** acts like a "canary in the mine" to alert home owners that shock waves are occurring in their plumbing system.

If all water hammer is to be prevented, it would be advisable to install a hammer suppression device at each automatic appliance solenoid and quick closing valve. To control costs, eliminate noise and minimise the impact of shock waves, a fabricated air chamber may be installed as an alternative, as suggested on pages a10 & a11. Air chambers have some disadvantages, which are explained on page a13.

## 2. MORE FACTS ABOUT WATER HAMMER

- Water hammer will occur with or without noise.
- When a quick closing lever tap or solenoid valve closes it can produce a shock wave of up to 3000 kPa & more.
- Tests show that if a quick closing valve is closed when only trickle of water is coming from it, the shock wave is still around 2000 kPa.
- AS/NZS 3500 states that to disconnect the water meter, taps, appliances and other fixtures that may be damaged when testing the water service at 1500 kPa. Then consider the damage being caused at 3000 kPa every time a quick closing valve is closed.
- The harder the pipe material the greater the noise but it is not the noise causing damage it is the shock waves.
- Pipe work and fixtures can be damaged with or with out noise if water hammer is not controlled. The noise provides a warning, therefore, any potential damage can be eliminated.
- All water services, which contain a quick closing valve, should be fitted with a hammer suppression device as recommended by AS/NZS 3500.
- To prevent damage the following recommendations should be followed for copper and plastic installations.

**Note:** A hammer suppression device refers to a Hammer Arrester and an Air Chamber.

### 3. STEPS IN PREVENTING WATER HAMMER

- If the water pressure is above 500 kPa always install a 500 kPa pressure - reducing valve at the water meter. This will eliminate the need for a pressure-limiting valve at the hot water system and this does not increase the cost.
- Clip all pipes as per AS/NZS 3500.
- Preferably use stand off clips.
- If the pipe runs along a stud install extra clips.
- Always install at least one hammer suppression device on the cold supply and one on the hot supply in the location stated on page a10.
- Use ball valves in place of loose jumper valves where possible. (E.g. at the meter when the meter is fitted with a non-return valve).
- Install loose jumper valves at a lever tap only when required by the contract or a local regulation (the stop taps are not required by AS/NZS 3500).
- If a loose jumper valve must be installed, use a spring-loaded washer.
- When penetrating a stud, ensure the silicon is evenly distributed around the pipe.
- If a non-return valve is required prior to the dishwasher, install it as far away as possible from the dishwasher. (E.g. at the hot water system if on hot water or at the meter).'

## **4. STEPS TO LOCATE WATER HAMMER**

### **(NEW HOUSE)**

- When installing the roughin, install it as per the directions on the previous page STEPS IN PREVENTING WATER HAMMER.
- On completion of a roughin, install a ball cock and pressuregauge on the line and close it off quickly. This will indicate if and where a hammer problem exists.
- If the installation has been installed as per the STEPS IN PREVENTING WATER HAMMER, the problems are likely to be insufficient clips, faulty valves or incorrect positioning of valves.
- As stated before, if a pressure-limiting valve is required at the dishwasher, it should be placed as far away as possible to allow the connection of the hammer suppression device to be installed between the dishwasher and the valve. When the valve is placed close to the dishwasher the shock waves will hit the valve at around 3000kPa causing damage to the valve. This is why sometimes a plumber may get a call back in about 2 to 12 months with a noise being generated by the pressure limiting valve.

## **5. STEPS TO LOCATE WATER HAMMER (EXISTING HOUSE)**

- Has a new dishwasher or washing machine been installed?  
A new machine may create a noise where it did not exist before.
- Check for faulty valves. The most common valves to be damaged by shock waves are pressure-limiting valves to dishwashers and valves to hot water systems, in particular solar hot water systems.
- Once the valves have been replaced, it is good practice to install hammer suppression devices whether the pipe work is copper or plastic, to prevent damage to the new valves.
- Check for faulty washers and replace them.
- Stop taps that remain open should have spring-loaded washers installed or preferably be ball valves.
- Check the clips on pipe work. Shock waves can loosen the clips.
- If water hammer noise is occurring when a tap is not being used, it could possibly be generated from the house next door. This occurs when the tapings to the two properties are close together.
- In this case, the neighbor's problem needs to be rectified or the washer in the main stop tap needs to be replaced. A hammer suppression device fitted to the water service downstream as far as possible works in most cases.
- Check the water pressure and install a 500kPa pressure-limiting valve if necessary.
- If a noise appears that did not exist before, it is almost certain that damage has occurred by shock waves.

## 6. COMMON CAUSES OF WATER HAMMER

The following are some examples of water hammer problems that have occurred and rectification solutions:-

**(Problem)** Two months after installation a hammer noise occurred at the kitchen sink.

**(Solution)** Shock waves damaged the pressure-limiting valve installed at the dishwasher. The valve was repositioned at the hot water outlet of the hot water system and air chambers installed. In one case there was an air chamber installed but the shock wave had to pass through the valve before it was controlled by the air chamber.

**(Problem)** A plumber had pinned the washers to all washing machines in a block of units and installed a hammer arrester near the pump at the entry to the building. Water hammer noise still existed.

**(Solution)** Spring-loaded washers were installed on the stop taps to each laundry. This solved the problem of the noise but a hammer

suppression device on each line would control the shock waves and extend the life of the washing machine hoses and solenoid valves.

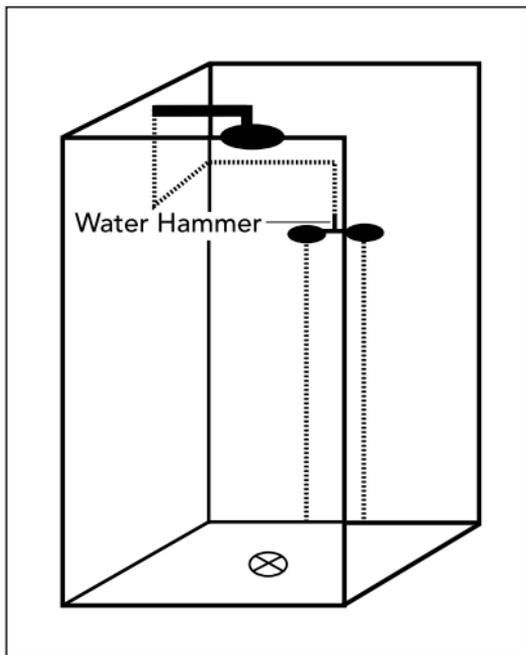
### Common causes

- Hammer suppression devices installed in the wrong position.
- Hammer suppression device not installed and excessive pressure in the line.
- Loose pipes and faulty valves some times caused by shock waves.

## 7. REVERSE WATER HAMMER

This is when water hammer occurs between the tap and the outlet when there is an extended distance of pipe work.

**For example**, when the pipe to a shower rose is extended to install the rose on another wall to the taps.



### Solutions:

- Install a hammer suppression device as close as possible to the taps on the outlet side.
- And/or reduce water pressure to 350kPa.
- And/or limit the volume of water to the rose.

## 8. VELOCITY NOISE

The common causes of velocity noises are;

- Excessive pressure.
- Restrictions in the pipe work.
- Diameter of pipe too small (not installed as per AS/NZS 3500)

The following steps can be taken to reduce velocity noise;

- Reduce the pressure to no more than 500kPa AS/NZS 3500.1.2 states the velocity shall not exceed 3.0 m/s therefore a DN15 pipe is not permitted to deliver more than 16.7 L/min. If more than 16.7L/min is being delivered at the outlet of a DN15 pipe then the velocity is above 3m/sec, (40.9L/min for DN20). AS/NZS 3500.1.2 also notes that the maximum pressure should not exceed 500kPa at any outlet.
- Use a pipe cutter in good condition and cut the pipe without using excessive force.
- If the pipe cutter blade is damaged or worn or the cut is performed too quickly, an excessive burr will occur on the pipe restricting the flow. This will generate a noise as the water passes this restriction. ( AS/NZS3500.1.2 states the burr formed in cutting any pipe shall be removed)
- Use pipe benders where ever possible.

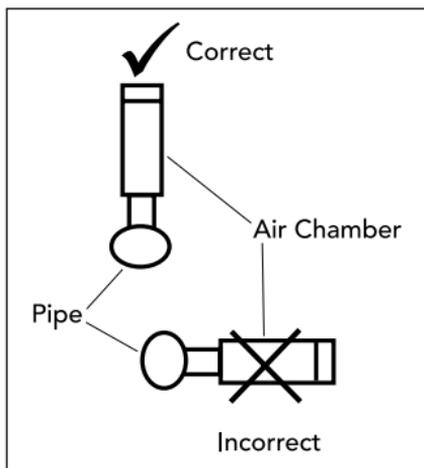
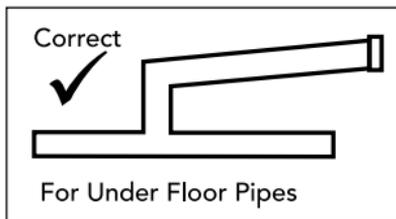
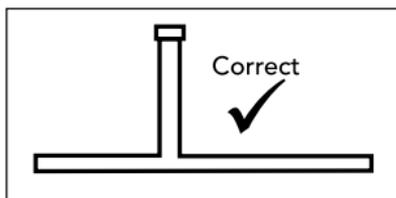
If a velocity noise occurs mainly due to restrictions in the pipe, then the installation of a 350kPa pressure limiting valve will in most cases reduce the noise to an acceptable level.

## 9. POSITIONING OF VALVES TO PREVENT DAMAGE

- Shock waves cause damage to valves. This damage initially does not prevent the valve from working but may create extensive water hammer noise.
- If a 500kPa pressure-limiting valve is installed at the meter, there is no need to install one at the hot water system or the dishwasher if it is connected to the cold water supply.
- If the dishwasher is connected to the hot water and the manufacturer requires the installation of a pressure-limiting valve, install the valve near the hot water system rather than the dishwasher.
- Valves to solar hot water systems can also be damaged by water hammer and create excessive noise.
- When valves are installed, install the valves (that are not part of the appliance or regulations require them to be installed at the appliance) as far away as possible from the appliance. E.g. pressure limiting valve for a dishwasher.
- Install an air suppression device between the valve/s and the appliance/ quick closing valve.

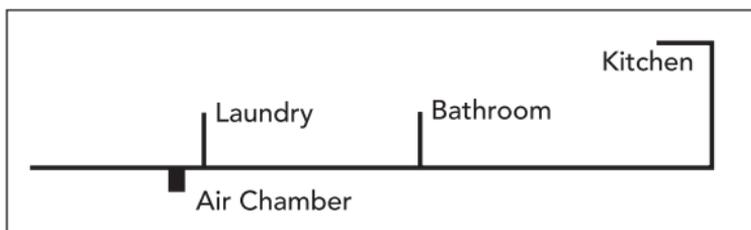
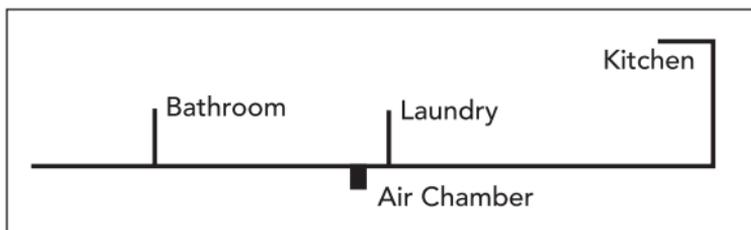
## 10. SIZE OF AIR CHAMBER

- A minimum tube size of DN 20 should be used for the air chamber on DN 20 and DN 15 pipes.
- The recommended length is 1.5m. If this proves difficult to install, the length may be reduced to no less than 1 m.
- To reduce the length less than 1 m, the diameter needs to be increased.
- Always connect the air chamber vertically on the water line. (see diagrams)



## 11. POSITION OF AIR CHAMBER

- One air chamber should be installed on the cold water and one on the hot water of an average house.
- In a block of units each unit needs to have air chambers installed.
- The best position for an air chamber, when only one is being installed, is on the main line (of the hot and cold lines) immediately downstream of the first branch to a quick closing valve or washing machine.
- The following examples are when the bathroom does not contain quick closing valves and the kitchen has a lever tap.



## **12. DAMAGE THAT HAS OCCURRED DUE TO WATER HAMMER**

### **Metallic pipe installations.**

- Excessive noise.
- Damaged valves.
- Creation of noisy valves.
- Clips loosening.

### **Plastic piping (the type of damage may be different for different types of pipe).**

- Ruptured pipe.
- Vibration of pipe when not clipped.
- Damaged valves.
- Creation of noisy valves.
- Joints loosening and resulting in leaks.
- Clips breaking.

The installation of hammer suppression devices, whenever a quick closing valve or solenoid is installed, will extend the life of valves, fittings and appliances such as washing machines and dishwashers.

**Note:** There does not need to be a noise to create damage to the installation. Whenever a quick closing valve or solenoid is installed, it is only a matter of time before damage occurs unless the shock waves are controlled in both metallic and plastic piping.

### 13. PREFERRED DEVICES THAT WILL HELP TO ELIMINATE WATER HAMMER

- **Hammer suppression devices.**

Hammer suppression devices include the following;

- a) Hammer arresters.**

- (advantage) long lasting, some have a life time guarantee if installed as per manufacturers specifications.

- (disadvantage) greater cost

- b) Air chambers.**

- (advantage) cheaper cost.

- (disadvantage) will progressively lose air and gradually become ineffective therefore they will need to be recharged with air at least every three years. This can be achieved when the water is turned off and the pipe drained to change a tap washer. The air chamber will not permanently eliminate all shock waves but will initially eliminate the noise and limit the impact on pipes, fittings and fixtures.

- **Soft closing lever taps.**

- **Ball valves** where possible in locations where taps remain in the on position.

- **Spring loaded washers** in other locations where taps remain in the on position.

- **500kPa pressure limiting valve.**

## **14. COPPER INDUSTRY HELPLINE**

If you have been unable to resolve the water hammer problem after reference to this book, we have a service to assist by phone, fax or email.

### **By Phone**

Call our technical expert, Allan Archie on **1800 HAMMER (1800-426 637)**

### **By Email**

Email: [cdc@copperdev.com](mailto:cdc@copperdev.com)

### **By Fax**

Fax number: 02-9380 2666

Please fax through or attach a diagram of the premises indicating the following;

- All pipe work, hot and cold.
- Measurements (approximately)
- Source of the noise
- Water pressure.
- HWS location.
- Water meter location.
- Location of quick closing valves.
- Location of any additional valves (e.g. PLV at dishwasher)

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