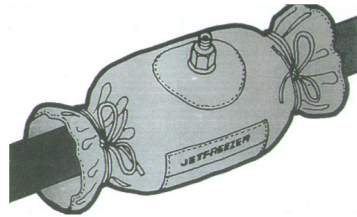


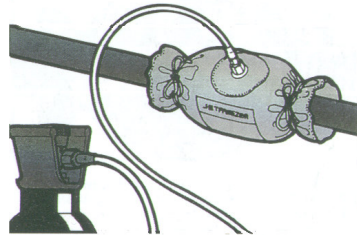
Operating Instructions

These illustrations show the basic essential operations to obtain a freeze. Pipefreezing with Jetfreezer is a safe technique but there are a few precautions which should always be observed. Please read the safety section below before you start work.

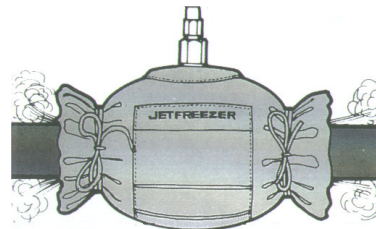
1. Select the correct jacket size for the pipe to be frozen, visually check the jet on the jacket is clean and free of dirt and then wrap it around the pipe and press the Velco strips together to make the jacket into a tube. Then tie the nylon cords ensuring that they are as tight as possible to make an enclosed 'bag' around the pipe. Ensure there is no flow of water through the pipe.



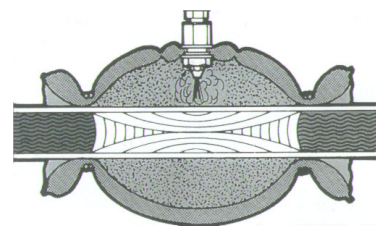
2. Stand the cylinder in a vertical position with valve uppermost. Connect the high pressure hose between the CO₂ cylinder and jacket, using the special CO₂ sealing washer on the cylinder connection. The jacket has a conical fitting and needs no other sealing. Use spanners to ensure a gas tight seal on the 'cone end' joint.



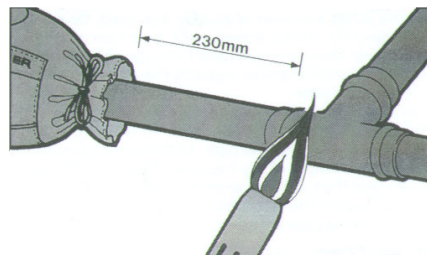
3. Open the cylinder valve and inject CO₂ into the jacket for the required time. See full instructions below for injection times and freezing times. These times apply to unpainted metal pipes containing cold static water. Plastic pipes take about three times as long to freeze. Note that gaseous CO₂ will escape through the fabric of the jacket and this is quite normal. However, the solid CO₂ particles should be trapped by the jacket and should not escape. Wearing the gloves provided periodically press the jacket around the pipe so that the solid CO₂ inside the jacket is evenly packed around and in contact with the pipe walls. **Caution:** Damage to the jacket may occur if injection times are exceeded resulting in overfilling, or if used when wet.



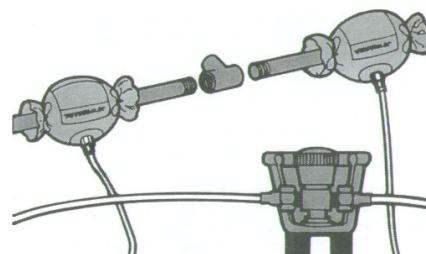
4. Once the ice plug has formed, and providing the jacket is left in position, no further injections will normally be required for 30-45 minutes depending upon ambient temperature. To secure the plug for longer than this a further injection of CO₂ can be made. Alternatively, for long jobs the pipe can be capped-off and re-frozen when the job is ready for re-connection. There is no danger of the pipe bursting, since with Jetfreezer only the water immediately beneath the jacket is frozen. When an ice plug is formed, the upstream water supply may be turned on if it is necessary to do so.



5. With the section isolated by the ice plug, work can proceed with the repair or extension. The jacket should be positioned at least 230mm (9 inches) from any work requiring a blow lamp to ensure satisfactory solder flow. When the job is finished the jacket can be removed and the ice plug inside the pipe will melt away within minutes. The dry ice remaining in the jacket can be flushed down the toilet, or put in a dustbin. The dry ice will evaporate to CO₂ gas by itself within a few minutes. It will not damage carpets or polished floors. Ensure that children or animals do not come into contact with dry ice. Always wear protective gloves when handling dry ice.



6. To insert a tee piece or isolate a valve two Jetfreezer jackets should be used. The Jetfreezer tee enables them to be connected to one cylinder. Jetfreezer can even freeze warm water. Place two Jetfreezer jackets of the correct size side-by-side, touching each other. This will act like a single double-length jacket. Freeze with both jackets simultaneously to produce a double-length ice plug. This extra long ice plug will stop any convection currents in the hot water but you will have used up a lot of CO₂ in cooling down the pipe. Warm horizontal pipes are easier to freeze than warm vertical pipes.



Total Freezing Time and CO₂ Consumption

The amount of CO₂ needed will depend upon the size of the pipe to be frozen. Before starting, make sure you have enough CO₂ for the job in hand. CO₂ cylinders change weight but not pressure as they empty. The gross or full weight and the tare (empty) weight is stamped on the neck of every Jetfreezer cylinder.

The cylinder is effectively empty when it weighs about 1 kg (2 lb) more than the tare weight. This allows for residual gas that cannot be used for freezing.

Pipe Size OD (mm)	15	22	42	50	63	75	88	100
Approximate quantity of CO ₂ required (kg)	0.3	1.0	1.5	4.1	6.4	9.1	12.7	16.3
Approximate amount of time required (mins)	3.5	10	27	35	50	77	94	128

The above times are for unpainted metal pipes and static water starting at room temperature. Allow about 3 times as long for plastic pipes to freeze.

Difficulty in Obtaining a Freeze

There are a number of reasons why a freeze may not occur:

1. Cylinder is empty – if this happens no dry ice will form in the jacket when injection takes place and it will feel soft, rather than hard when full of dry ice.
2. There is a flow of water in the pipe – if there is a significant flow in the pipe, a freeze will not take place. One indication is that only the pipe at the downstream end of the jacket will feel very cold. The water movement may be the result of convection currents in warm water, or an open valve, etc. If the movement is very small its effects can be minimised by placing two jackets side by side, so that they touch and then by following the usual procedure, freeze with both jackets simultaneously.
3. Not enough time has been left for the freeze to take place – if a valve is opened before the pipe feels cold and before the ice plug has completely formed, the whole operation must be started again. From operating instruction paragraph 2 since any ice that had built up will have been lost.
4. Cylinders are too hot – cylinder stored in bright sunlight or enclosed vans may heat up to a point where it is impossible to withdraw liquid. Cylinders must be below 30°C and ideally below 25°C.
5. Water in the pipe is hot – convection currents may be set up within the pipe preventing formation of an ice plug.
6. Type of cylinder is wrong – cylinder must be fitted with a syphon or dip tube to facilitate withdrawal of liquid.

For further information, please contact us.

SAFETY PRECAUTIONS

1. Under normal operating conditions, Jetfreezer is absolutely safe, but as CO₂ is heavier than air, care should be taken to disperse CO₂ gas in low lying and confined spaces, before commencing repair work.
2. Solid CO₂ is intensely cold (-78.5°C) and can cause cold burns and frostbite to bare skin. Always use the protective gloves provided. Keep animals and small children away from Jetfreezer equipment at all times.
3. All CO₂ cylinder valves are fitted with a safety bursting disc to guard against overpressure. The disc may rupture, either if the cylinder is over-filled or it is subjected to excessively high temperature (about 50°C – 120°F). Always store cylinders indoors in the shade and never in strong sunlight or near other source of heat. This will also conserve the freezing power of the CO₂ which is reduced when the cylinder becomes excessively warm.

4. Check the condition of your Jetfreezer equipment before use. If there is visible damage to the cylinder or hose, or signs of wear on any screw threads, that piece of equipment must not be used.
5. Jetfreezer cylinders may be carried inside or outside vans preferably outside in a specially constructed rack suspended below the rear doors.

If carried inside, the cylinder should be reliably secured with the valve adjacent to the rear doors and should be checked and weighed before loading to ensure that it is not over-filled.

6. Never carry a cylinder next to the driver in a lorry cab. If a bursting disc should rupture, the noise and discharge of CO₂ will distract the driver's attention.

INJECTION PROCEDURE

Jackets size 15mm/22mm – For pipes up to 22mm OD or 0.75" (19mm) n.b.

Connect the jacket and hose as already described. Open the CO₂ valve and inject CO₂ for 15 seconds only, then turn off the valve. During this time the jacket will have filled up with solid dry ice. Wearing the protective gloves, squeeze the jacket to pack the dry ice around the pipe.

Still wearing the protective gloves, squeeze the jacket firmly onto the pipe at intervals of one minute, to ensure good contact between the solid CO₂ and the pipe. At the end of 3 minutes, or if the jacket feels empty of dry ice, inject for a further 15 seconds if necessary and then wait for another 3 minutes. Again, periodically squeeze the jacket onto the pipe. Continue this procedure until the pipe is frozen.

Jackets size 42mm – For pipes of 22mm–42mm OD or 0.75"–1.5" (19mm-38mm) n.b.

Follow the procedure given above exactly, with the exception that injection times should be 30 seconds and the interval between injections should be 5 minutes.

Jackets size 80mm and 100mm – For pipes of 42mm and of 40mm-100mm OD or 1.5"-4" (38mm-100mm) n.b.

Ensure that the two hoses are connected to the jacket and cylinders – or tee piece and one cylinder. Turn on the cylinder(s) and inject continuously until the pipe is frozen (see table).

The jacket will gradually fill up with solid dry ice, and this should occasionally be packed around the pipe by squeezing the jacket wearing the protective gloves provided. Turn off the cylinder valve(s) and wait 5 minutes before commencing work.

For plastic and similar pipes, inject for 5 minutes, turn off the cylinder valve(s) and then wait for 10 minutes. Repeat the procedure until the pipe is frozen, which takes approximately three times longer than for metal pipes.



JETFREEZER

Portable Pipe Freezing Equipment

It is important to note that the most satisfactory results will be obtained by using the correct size of jacket appropriate to the pipe size.

When the pipe is frozen, it will feel extremely cold around both ends of the jacket, and frost rings may appear.

Do NOT attempt to do any work until you feel the pipe to be 'ice cold' at BOTH ends of the jacket.

Once the ice plug is formed, no further injections will normally be required for between 3-45 minutes depending on the ambient temperature. After this time, or sooner if the jacket feels empty, re-inject and fill the jacket with dry ice to maintain the freeze.

As long as the Jetfreezer jacket is full of solid dry ice, the ice plug inside the pipe will remain hard and will not move. However, it is advisable to squeeze the jacket onto the pipe every 5 minutes to ensure that the dry ice maintains good contact with the pipe wall.