COLD CLAMP™ SYSTEM

USER MANUAL

Congratulations on your purchase of this equipment, which has been engineered to provide the best possible convenience and performance. Please spend a few minutes to read this manual.

6th Edition.
Australian & International patents granted.

Cold Clamp is a registered Trade Mark.

1. INTRODUCTION & APPLICATIONS

The Kingfisher Cold Clamp system is a revolutionary breakthrough for precisely locating faults in fibre optic cable systems. It has been proven on jelly filled fibre optic cable with acrylate coated fibres typically used in underground or submarine applications. It accommodates cable up to 38 mm diameter.

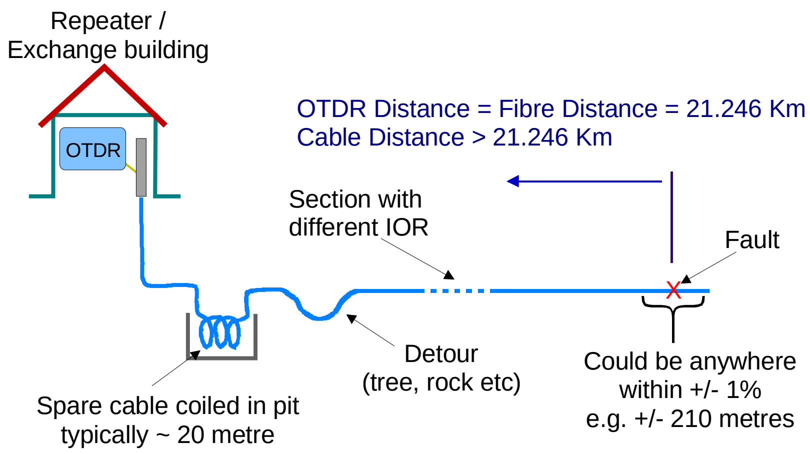
Deployment of this system requires training of appropriate personnel (eg liquid nitrogen [N2] handling methods, and a practical demonstration), but actual use of the system is simple and reliable.

For a modest investment in equipment, facilities and training, the Cold Clamp system can:

* Dramatically improve productivity of fibre optic cable maintenance procedures.
* Improve network availability.
* Increase the lifetime of your cable network by reducing cable damage from pressure points and attempted repair.

1.1 Application 1: Fault location

Although an OTDR (Optical Time Domain Reflectometer) measures exact fibre distance (some OTDR up to 1% accurate = $\pm$20m per km), the physical location of an optical fault is often uncertain. In cases of cable defects or ground instability causing optical faults, locating the exact point loss using only an OTDR can take days of work, and can create a hazard to the cable while large sections of it are being unearthed. Using the Cold Clamp system in conjunction with an OTDR enables the job to be completed quickly and with minimal cable disturbance.



A Cold Clamp reservoir is attached to the cable close to the estimated location of an optical cable fault. Liquid nitrogen is then poured into the Cold Clamp reservoir, which creates a temporary optical point loss of approximately 0.2 - 1 dB at the point on the cable where it is located. This can be readily detected by an OTDR, and it's distance relative to the fault point determined to an accuracy of typically 1 metre. Because this loss is low and predictable, the Cold Clamp system can typically be used without disrupting traffic on the cable being tested.

1.2 Application 2: Cable diameter shrinkage detection

If underground type fibre cables are not mechanically terminated correctly in an above-ground closure, or any place where extremes of hot and cold are encountered, cable diameter shrinkage can cause excessive optical loss, particularly in cold weather at 1550 nm and above. This is often discovered as systems are upgraded to 1550 nm, and is often initially identified as a splice problem. The Cold Clamp can be used to confirm the situation with little cable disturbance. If a Cold Clamp is applied to a faulty end, a high loss will be created.

1.3 Application 3: General marking and location for future reference

Cold Clamp users find that it is frequently faster and more accurate to mark cable positions with the help of a Cold Clamp, even when the cable is easily accessible and has position markers printed along its length. This enables an optical reference point to be located on an OTDR trace to identify a known critical point, so that if something occurs in future, the location is already known.

2. SAFETY WITH LIQUID NITROGEN

NOTE For detailed information, ask your local supplier of Liquid Nitrogen (N2) for a copy of their Material Safety Data Sheet (MSDS)

NOTE Liquid Nitrogen is a potentially dangerous substance if it is not handled, stored, transported and used properly. As Liquid Nitrogen is a major component in the operation of the Cold Clamp system, users must be aware of and comply with all relevant statutes, codes, regulations and standards applicable to the transport, purchase, storage, handling and use of liquid nitrogen.

The Cold Clamp system has been manufactured in compliance with Australian Regulations 432 and 503 of the Dangerous Goods (Storage and handling) Regulations, 1989. Users should check their local regulations with regard to the handling of liquid nitrogen.

Only personnel fully trained and approved by the company should handle liquid nitrogen.
<u>If in doubt, do not proceed!</u>
Please refer to the Disclaimer at the end of this manual.

Liquid nitrogen is a colourless inert liquid, with a boiling point of -196°C at normal atmospheric pressure. Possible hazards introduced are cold burns caused by skin contact with a cryogenic liquid or cold metal parts asphyxiation caused by nitrogen vapour displacing oxygen and a fire hazard caused by oxygen concentration at the liquid nitrogen surface. These are adequately addressed by proper procedures.

2.1 Asphyxiation Hazard

A significant hazard associated with liquid nitrogen is that when liquid nitrogen boils off, the (cold and heavy) nitrogen vapour can create an asphyxiation risk.

The human body has no natural detection mechanism for an atmosphere low in oxygen content. It is important to realise that the victim may well be unaware that he or she is being asphyxiated and could become unconscious without any discomfort or pain. It is therefore crucial that proper preventative procedures are used to prevent personnel entering a contaminated space and that a second person is in attendance.

After the nitrogen gas warms up to ambient temperature, it tends to disperse into the atmosphere where, in the open air, it becomes harmless. Normal atmospheric nitrogen concentration is about 78%. It is only dangerous when it displaces oxygen in sufficient amounts to cause asphyxiation.

21% oxygen is the normal atmospheric level, 19.5% oxygen is the minimum limit for safe working, below 18% is considered dangerous, and below 10% may cause brain damage or death. 1.5 litres of liquid nitrogen will generate 1 cubic metre of nitrogen gas.

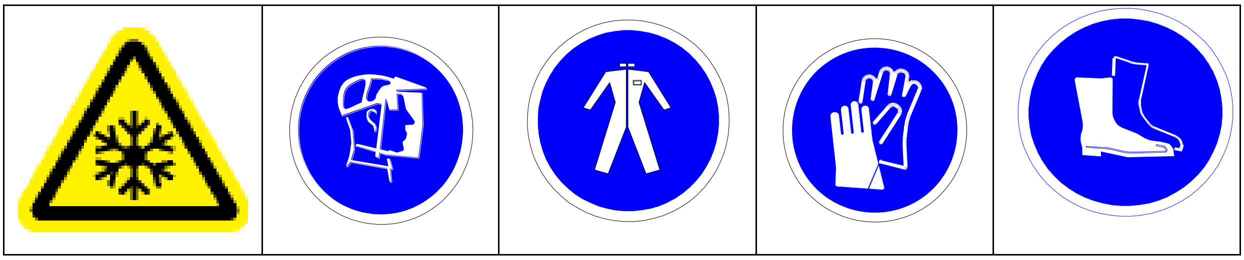
Therefore, one use of the 0.5 litre applicator flask, with nitrogen gas evenly dispersed in a confined space, creates the following hazard level:

22 cubic metre	(790 cubic ft) confined space:	within safe working limits
11 cubic metre	(390 cubic ft) confined space:	within danger limits
3 cubic metre	(39 cubic ft) confined space:	within lethal limits.

The Cold Clamp system is carefully designed to minimise liquid nitrogen use, and therefore the asphyxiation hazard.

Many cable installation crews are familiar with low oxygen gas risks introduced through previous work in pits, tunnels and other applications. It is strongly recommended that work crews are equipped with and trained to use oxygen monitors and other devices to detect general gas hazards in cable pits, in which case this risk is covered by enforcing use of this equipment.

2.2 Cold Burns Hazard



Minor splashing of liquid nitrogen onto the skin may not cause any problem. However splashing into the eyes, or soaking of clothes or shoes by accidental spillage does create a serious burns hazard.

Unprotected parts of the skin coming into contact with uninsulated items exposed to liquid nitrogen, especially bare metal, will immediately stick fast to them and the skin may tear on removal. The protective clothing in the Work Kit is provided and must be worn to protect the wearer from accidental contact with liquid nitrogen or cytogenetically frozen surfaces.

The non-absorbent leather gloves protect against accidental contact and adhesion to cold items. They should be a loose fit to allow fast removal should liquid nitrogen splash into them.

The face mask protects the eyes and face from minor liquid nitrogen splashes. This face mask should only be used as protection when using the Cold Clamp system, and not for other activities.

The overalls and over-boots prevent splashed or sprayed liquid nitrogen being absorbed by clothing, and particularly from spillage into footwear.

Cold burns and hot burns are very similar, and are treated the same way.

2.3 Transport of Liquid Nitrogen

Proper shipping name:	Nitrogen, refrigerated liquid
Hazard Class Number and Description:	2.2 (Non-Flammable Gas)
Hazchem Code	2RE
UN Identification Number:	UN 1977

It may be required to handle liquid nitrogen at the depot prior to transporting it to the work site. For this procedure, trained and approved staff should wear the protective over-boots, gloves and face shield as a minimum.

It is strongly recommended that nitrogen flasks are transported securely fastened and kept upright within the tray in an open vehicle, e.g. ute, pick-up truck, open backed lorry, or trailer, and that it is not transported on the exterior of a vehicle (where it could become damaged in a minor collision).

Do not attempt to seal the Dewar, and at all times allow for evaporating gas to escape freely, to avoid build up of gas pressure.

The container for the 1 litre Dewar has been designed to be securely strapped into a standard Jerry can holder that has been fixed to a transport vehicle.

Warning! Flasks containing liquid nitrogen must never be carried within any compartment (e.g. a boot or trunk) which vents into a compartment containing passengers or animals.

2.4 Fire Hazard

Non-flammable, inert cryogenic liquid. Use extinguishing media appropriate for surrounding flammable product.

Surfaces at liquid nitrogen temperature will condense oxygen directly from the atmosphere, and so as a routine precaution any naked flames and cigarettes should be extinguished when transferring liquid nitrogen.

2.5 Summary of Recommended Defensive Procedures

* Train staff in appropriate procedures, equipment, safety regulations and first aid.
* Ensure that a second staff member is present at all times when liquid nitrogen is being handled.
* Use the provided personal protection equipment (PPE) to prevent cold burns.
* Store liquid nitrogen in an area with adequate ventilation, away from pits, cellars or other areas which could fill with nitrogen gas in the event of a spillage.
* Transport liquid nitrogen in a vehicle so that it does not vent into the passenger compartment or boot / trunk.
* Minimise the amount of liquid nitrogen taken to work sites.
* Ensure that field staff are equipped with oxygen monitors when working in confined spaces.
* No naked flames where nitrogen is being handled.
* Do not modify the flask lid, it has been designed to allow gas to vent. Flasks containing liquid nitrogen must always be held in an upright position.

3. DESCRIPTION OF EQUIPMENT

The equipment performs the functions of:

* Liquid nitrogen storage and transport container (10 Litre Dewar)
* Liquid nitrogen transport container (1 Litre Dewar)
* Protective equipment, manual, tools and applicator flask (Work Kit)
* Cold Clamp reservoir and consumables

The 10 Litre Dewar provides approximately 1 month liquid nitrogen storage under static conditions. It is also approved for use by many courier and transport companies when shipment to a work site or local depot is required.

The inexpensive 1 Litre Dewar set is convenient for use by personnel where they can pick up liquid nitrogen from a 10 litre Dewar at a depot, and use it the same day. It saves the cost of multiple 10 litre Dewars and minimises the amount of liquid to be transported and taken on site. This Dewar set comes in a container that fits onto a vehicle's 'jerry can' holder, and is recommended for journey times up to 2 hours.

The Work Kit provides all of the Personal Protection Equipment (PPE) required by trained personnel to handle liquid nitrogen and apply it to the Cold Clamp reservoir.

The Cold Clamp reservoir itself is typically used only once. <u>With suitable safety precautions</u>, the device can be used in a trench, manhole or ventilated walk-through cable duct.

4. GETTING STARTED

To get started, you can purchase a Starter Pack, (Cold Clamp-1) which provides sufficient equipment for one crew at one depot to use the Cold Clamp system 10 times.

You might need to purchase extra equipment for other crews, other depots, 1 litre Dewar set, and more spare Cold Clamp reservoirs. You will need to re-order Cold Clamp reservoirs on a regular basis from your dealer as they get used.

You will need to locate a supplier of liquid nitrogen, arrange delivery, and locate a storage position in the depot.

You will need to work out a transport strategy to get the liquid nitrogen on site. This could involve any combination of: a courier company or your own personnel using the 10 litre Dewar, or your own personnel using the 1 litre Dewar (maybe fitted in a jerry can holder located with free air movement on a vehicle).

Most safety and training issues are covered in this manual, however you will need to check local safety regulations before starting training. Your liquid nitrogen supplier should be able to inform you on these and supply you with a copy of the Material Safety Data Sheet (MSDS). You should also check if your company has any internal procedures for the use of liquid nitrogen or nitrogen gas.

Get your OTDR operators to check that their instruments are functioning correctly, and also ensure they are familiar with how to use their OTDR for <u>fault finding</u> as opposed to installation certification. For fault finding, the instrument needs setting to a short pulse width, and a long averaging period.

It is preferable to experiment with this technique to verify liquid nitrogen procurement, storage and transport strategies, work practices, ancillary equipment, OTDR operation and verify the performance of your cable type in this situation, before use of the Cold Clamp system on your network cable.

5. HOW TO USE THE COLD CLAMP SYSTEM

5.1 Where to Attach a Cold Clamp Reservoir

A Cold Clamp reservoir is preferably located at a position close to the suspected fault, but far enough away so that the OTDR event dead zone would not obscure the expected trace, and on the side nearer to the OTDR.

The trench dug to expose the cable is preferably a minimum length of 2 metres to allow the user unrestricted access to the cable and easy entry and exit from the trench, and to allow the nitrogen vapours in the trench to mix freely with the atmosphere.

Provided the proper procedures are observed for asphyxiating gases, the technique can be used in a manhole, ventilated conduit or other restricted spaces.

5.2 Attaching the Cold Clamp Reservoir

Where the Cold Clamp reservoir is to be applied, clean and dry the cable.

Build up a seal around the cable by wrapping the supplied black sealing strip firmly around the cable. As you apply the sealing strip to the cable, remove the protective backing. Use the gauge to bring the diameter up to 40 mm.

Use a Cold Clamp reservoir moulding as a guide to position the second seal with a gap of 190 mm from the first. Ideally, the seals are positioned so as to sit between the securing bolt holes.

Position the two halves of the Cold Clamp reservoir together with the top facing up and the seals positioned in the glands. Place the threaded rods, washers and wing nuts and tighten the wing nuts in sequence, bringing the foam halves firmly together to create a good seal around the liquid nitrogen chamber.

The wing nuts are tightened correctly when the washers are starting to sink into the foam.

If appropriate, with the Cold Clamp reservoir in position, firmly bed soil around the base of the reservoir and exposed cable to stabilise the assembly.

If not already available, a reference OTDR trace should now be measured for the faulty cable section.

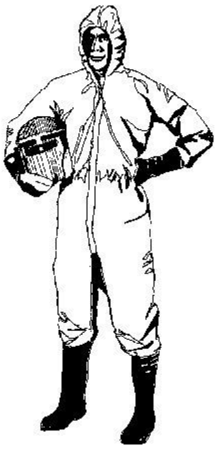
If there has been some delay between tightening the wing nuts and pouring the nitrogen, it is preferable to re-tighten the wing nuts before pouring.

The liquid nitrogen may now be poured in.

5.3 Application of Liquid Nitrogen

Only staff with suitable training shall handle liquid nitrogen. Ensure all other personnel are clear of the immediate work area.

Put on over-boots, overalls face mask and leather gloves before handling the liquid nitrogen.



Before filling up the applicator flask, you may like to use the empty flask to check that there is adequate space to enter and exit the work site, and for the filling operation.

To minimise spilling, the applicator flask has a cog on the side which is meshed with a cog on the Cold Clamp reservoir. In the start position, the flask should sit comfortably on the side of the Cold Clamp. As the flask is tipped, it is guided by the cog to pour neatly into the liquid nitrogen chamber. In situations where there is adequate ventilation, this can be performed by hand.

Alternatively, the length of string provided can be used to lower and tip the applicator flask. This enables use of the Cold Clamp system in confined spaces, without personnel having to enter the pit once liquid nitrogen has been poured. See the guide on the side of the flask for a convenient method of attaching and detaching the string.

Fill the applicator flask with liquid nitrogen.

Locate the applicator flask onto a cog on the Cold Clamp reservoir, allowing the base to rest on the lower edge of the clamp. Then slowly pour in liquid nitrogen to cover the cable. Initially there will be quite rapid boiling off, but this will slow as the cable cools.

Depending on the working conditions, it may be appropriate to occasionally top up the liquid as it boils off.

For maximum cooling period: The extreme thermal conditions cause some contraction of the Cold Clamp reservoir, which can result in some slow nitrogen leakage. For maximum cooling period, tightening the wing nuts a minute after the nitrogen has been poured will ensure no nitrogen loss, and longest possible operating time. Alternatively, (to avoid entering a pit after the nitrogen has been poured), position extra butyl putty sealing tape around the joints of the liquid nitrogen chamber during the Cold Clamp reservoir assembly. One of these procedures is required only if an extended cooling period is essential.

To avoid any possibility of cable damage, avoid disturbing the cable while it is frozen.

5.4 Monitoring with an OTDR

The test wavelength on singlemode fibre may be 1300 - 1650 nm. If 1550 nm is available, it gives a larger response than 1300 nm. Set up an OTDR with the pulse length set at the shortest possible period (e.g. 10 - 100 nsec) that produces a trace of the fault region. Minimising the pulse length minimises the OTDR dead zone, and gives better fault location accuracy. It may be necessary to leave the OTDR to integrate for several minutes to enable the OTDR user to reliably detect the 0.2 - 1 dB loss created by the liquid nitrogen. Process and store the trace so that it can be compared later on with the trace including the Cold Clamp system loss.

Then pour the liquid nitrogen. During the initial cool down period, the OTDR averaging should be off. A point loss of 0.2 dB to 1 dB should become apparent on the OTDR trace within about 2 minutes of liquid nitrogen first being applied to the cable. Averaging may then be used to improve the resolution of the trace.

The distance from the centre of the Cold Clamp reservoir to the fault point can now be accurately measured using the OTDR cursors. Cursors should be positioned at the start of each optical event for best accuracy.

If it appears that the Cold Clamp reservoir is so close to the fault that one or another is hidden in the dead zone, then use of the stored waveform may help resolve the situation. There may be odd occasions where, due to OTDR dead zone effects, it is necessary to apply a Cold Clamp reservoir in another position further away from the fault.

Remember that when measuring distances with an OTDR, you might need to make some allowance that fibre distance is not exactly the same as cable distance. With the short distances usually involved with the Cold Clamp (e.g. under 1 Km), this is not normally very significant.

5.5 Site Security and Clean Up

Keep unauthorised personnel away from the liquid nitrogen during use. Do not leave the site unattended until the liquid nitrogen has boiled dry.

While there is liquid nitrogen in the pit, and for some time afterwards, keep people away from the pit to avoid the possibility of nitrogen asphyxiation. Before re-entering the pit it is recommended to confirm that the atmosphere is safe using an oxygen monitor.

Leave the Cold Clamp reservoir in place when finished. There are several reasons for this:

* It avoids sending crew into the pit which may have nitrogen vapour in the bottom
* It avoids accidentally damaging the cable while it is extremely cold.
* It enables better long term managing of faults, should it be required to know where the device has been previously used (the bolts will respond to a metal detector).
* The Cold Clamp reservoir may not seal properly if used again.

Do not disturb or re-bury the cable until the liquid nitrogen in the Cold Clamp reservoir has boiled off, and the cable is free of frost. If the cable is moved before coming back to ambient temperature, there is a small possibility of damage to the polymeric components of the cable.

SPECIAL NOTE:
Remove the cold clamp after use if you suspect you are in a termite infested area as they may cause damage.

5.6 Problem Solving Guide

This section attempts to guide users in a situation where they have applied a Cold Clamp, but don't appear to be getting their expected results:

Is the cable type appropriate?
This system is proven to work on <u>jelly filled</u> cables, and may not work on other types. It will not work on cables with loose fibres and no jelly. It might possibly work on other types.

Is the liquid nitrogen staying in the Cold Clamp reservoir?
Check that the <u>liquid</u> remains covering the cable section while the OTDR is in operation. If it is leaking out, you should check the way you are assembling the reservoir onto the cable. It will normally stay for at least 10 minutes. If the reservoir is poorly applied and leaking, you may be able to just pour more nitrogen in, but be careful in case you run out of liquid nitrogen!

Still can't see any loss induced in the cable by the cold clamp?
You may have positioned the reservoir more or less over the fault, in which case the extra loss point may be hidden in the dead zone of the OTDR. Re-position the Cold Clamp to another point further away from the fault.

You may be using the wrong OTDR <u>pulse length.</u> Change the pulse length to under 100 n sec (the shorter the better- 50 ns is popular amongst experienced users). Pulse lengths in the 1 µsec region <u>will not work</u> very well, if at all.

You may need to increase your OTDR's ability to resolve events of around 0.1 - 0.5 dB with very short pulse lengths. To do this, increase the <u>averaging time</u> to several minutes to capture the loss details in the fault region.

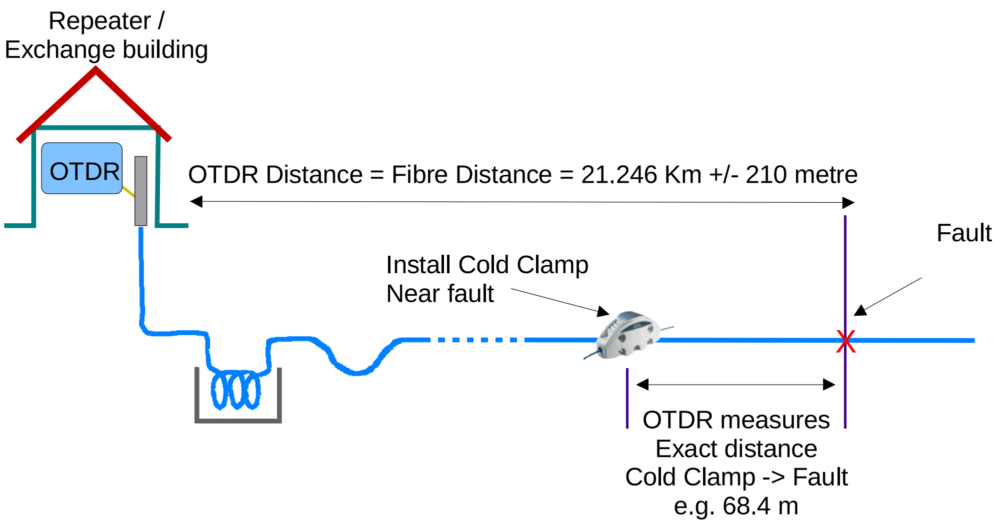
You may be unlucky. Occasionally a particular fibre may show very little loss induced by the Cold Clamp. Switch the OTDR to another fibre. If you are doing this, and the 'other fibre' does not show the loss point you are looking for but does pick up the Cold Clamp loss, allow for some reduced accuracy since OTDR distance measurements of parallel fibres do vary a bit.

6. THEORY OF OPERATION

The use of an Optical Time Domain Reflectometer (OTDR) to locate faults in optical fibre cables is now routine and is not discussed here. Fault location accuracy depends on, for example:

* Variation between fibre and cable length
* Variation between route distance and cable length
* Excess cable left in pits
* Variation in the refractive index of fibre sections
* Difficulty in measuring route distance accurately
* Ability of crews to accurately identify cable joints on cable route maps

On long spans, best actual location accuracy is typically worse than "100 meters.



The Cold Clamp system has been proven on cables containing acrylate coated optical fibre with jelly filling (it may also work on other cable types). It can be used on optical fibre cables carrying live traffic, and on armoured cable. On armoured cable, a high nitrogen boil off rate occurs due to heat conduction along the armouring.

The Cold Clamp system provides a technique for the introduction of a small, repeatable and non-destructive point loss on an optical fibre cable. This effectively reduces the distance dependent OTDR measurement errors enabling a nearby fault to be located to within 1 metre.

The loss typically appears within two minutes of applying the liquid nitrogen, and remains stable whilst the cable is kept frozen. After the liquid nitrogen is allowed to evaporate, the loss disappears within 2 - 10 minutes. The effect is reversible and the cable returns to normal after thawing.

Once the loss induced by the Cold Clamp system has been located on an OTDR, and it's distance from the fault measured, the same distance can be measured along the ground or cable jacket to establish the physical location of the fault. Assuming that the Cold Clamp reservoir was placed correctly, the small distance involved in this measuring process enable very accurate location of the fault.

7. EFFECTS ON CABLE RELIABILITY

Field and laboratory tests to date have shown that fibre optic cables are resistant to damage by liquid nitrogen. Cables are made of polymers that exhibit good ductile behaviour, which means that even under cryogenic conditions, these materials will tolerate considerable thermal stresses without cracking. No long-term effects have been observed.

However, we recommend that you try it out first on your cable design, since cable materials and design techniques vary widely.

7.1 Telcordia (Bellcore) Tests

A copy of the Bellcore (Telcordia) technical audit report entitled ‘Effects of Kingfisher Cold Clamp Application on Cable Structure & Materials’ may be made available from Kingfisher International upon request.

8. SPECIFICATIONS & ORDERING INFORMATION

Maximum cable diameter:	38 mm
Known applicable cable types:	fibre optic cable, jelly filled with acrylate coated fibre, including armoured types.
Reliability effects:	No long-term cable effects observed.
Typical loss created by Cold Clamp:	0.2 - 1 dB at 1300 - 1650 nm (fully reversible)
Typical usage of liquid nitrogen:	300 ml (15 mm diameter non-metallic cable)
Liquid nitrogen boiling point:	-196 C, -321 F
10 litre Dewar:	
boil dry time in static conditions:	45 days
Weight: empty:	6.1 Kg
Weight Full:	14.1 Kg
Size:	0.3 x 0.3 x 0.53 m
1 litre Dewar:	
boil dry time in static conditions:	2 days
Weight: empty:	0.9 Kg
Size	400 high x 165 x 320 mm

This product is protected by international patents. Cold Clamp is a registered trademark.

ORDERING INFORMATION	PART NUMBER
Starter Pack: 10 Litre Dewar Work Kit 2 Packs Cold Clamp reservoirs (total qty 10) Size: As components below	Cold Clamp-1
Cold Clamp Reservoir: Pack of 5 Cold Clamp reservoirs & consumables Size: 460 x 570 x 240 mm	Cold Clamp-2
Work Kit: Protective visor, gloves, over-boots, overalls, operator manual, applicator flask, equipment storage roll, cable gauge Size: 300 x 300 x 80 mm	Cold Clamp-3
10 litre Dewar: Size: 300 x 300 x 540 mm	Cold Clamp-4
1 litre flask: 1 litre flask:	Cold Clamp-5

Information given is based on existing known product performance. We reserve the right to amend these specifications without notice. Please phone Customer Service to confirm critical specifications and availability before ordering.

9. DISCLAIMER & WARRANTY

Kingfisher has prepared this User Manual for the benefit of the purchaser and its staff. Kingfisher believes that the information contained in this manual is accurate at the time of writing. Kingfisher is not liable for damage or loss arising from the negligent misuse or abuse of the Cold Clamp system or its components. Liability is limited solely to the cost of replacement or resupply of the goods; repair of the Cold Clamp system, and/or payment of the cost of replacement, resupply or repair for goods of equivalent value.

Kingfisher products are guaranteed against defective components and workmanship for a period of 1 year from the date of delivery, unless specifically stated in the original purchase contract or agreement.

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Winner of Photonic Spectra Award for Innovation & Design Excellence – 1997

10. FURTHER RECOMMENDED READING LIST

At the time of publication of this User Instruction Manual, the following Australian and Victorian publications are relevant to this product:

a) National Code of Practice for the Preparation of Material Safety Data Sheets (NOHSC:2011(1994)

b) Australian Standard 1894-1997 - The storage and handling of non-flammable cryogenic and refrigerated liquids

c) National Standard for the Storage and Handling of Workplace Dangerous Goods [NOHSC:1015(2001)]

d) National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC:2017(2001)],

e) National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC:2007(1994)]

f) National Model Regulations for the Control of Workplace Hazardous Substances [NOHSC:1005(1994)]

g) Dangerous Goods Act (1985)

h) Code of practise for the Storage and Handling of Dangerous Goods

i) Occupational Health and Safety (Hazardous Substances) Regulations 2000

j) ADG Code (Australian Code for the Transport of Dangerous Goods by Road and Rail)

Users should not rely on the contents of this User Instruction Manual in relation to the handling of liquid nitrogen and should obtain advice from the supplier of liquid nitrogen and other qualified persons having knowledge of relevant standards and regulations covering its use.

The Cold Clamp system is sold on the terms and understanding that:

- Kingfisher is not responsible for the result of any actions taken on the basis of information in this publication, nor, for any error or omission in this publication; and,

- Kingfisher in not engaged in rendering professional or other advice or service in relation to the handling of liquid nitrogen.

Kingfisher expressly disclaims all or any responsibility or liability to any persons in respect of anything done or omitted to be done by any such person in relation to the handling of liquid nitrogen whether wholly or partly based on the contents of this User Instruction Manual.