

# Operation and Maintenance

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## FreezCheck Trace heating installations

for freeze protection of piping systems.

- Includes commissioning
- Website QR code on last page

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## About the trace heating system

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Generally, water in a pipe will eventually cool to ambient temperature if it is not flowing - even if it is covered with insulation. If the water cools to below 0°C, it will start to freeze and continue to do so. To prevent freezing, piping is fitted with *FreezCheck* trace heating cable that has heat output sufficient to counter the natural heat loss from the piping and its insulation, even when the ambient temperature is as cold as -15°C.

The *TraceStat* thermostat energises *FreezCheck* when it measures 3°C pipe temperature during falling temperature. It will keep *FreezCheck* energised until it measures 5°C during rising temperature, at which point it will de-energise the cable. Mains power connects to the trace heating system at the *TraceStat*.

*FreezCheck* is usually applied to all piping that has the potential to be exposed to ambient temperatures below 0°C and to all piping that has the potential to be in a 'no-flow' scenario - such as a dead leg, or when there is no demand or the process has stopped or shut down. Generally, a trace heating system will not freeze-protect a piping system that is flowing. A pipe containing flowing water being continually replaced by water warmer than 0°C will not freeze if the flow rate is high enough.

Where parts of the trace heated piping have a larger diameter than 50mm, the *FreezCheck* cable will be affixed around the outside of pipe bends. Additionally, inline equipment such as pumps, valves and strainers will be wrapped with trace heating to accommodate additional heat losses due to their larger surface area and to provide sufficient cable slack in case they need to be removed. To accommodate pipe branches, 3-way or 4-way *JB420B* junction boxes may be fitted along the pipe routes.

*FreezCheck* is self-regulating so it can be overlapped and it won't overheat or burn out. When energised, *FreezCheck* is safe for careful manual handling and will only be warm to the touch.

The unique, serial numbered Test and Completion certificate from *Traceheaters Limited* confirms that each trace heating system was safe to power up on the date of the certificate. It also provides pertinent information for the power supply designer.

A trace heating system's performance is dependent upon its pipe insulation's performance.

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## Items you may need

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### References

Permit to work - if applicable  
Trace Heating Test and Completion certificate  
Applicable drawings  
Trace heating performance specification or requirements  
Commissioning documentation - if applicable  
Previous test documentation - if applicable

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### PPE

To suit site requirements  
Gloves

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### Hand tools

4mm flat head VDE screwdriver  
Ph2 VDE screwdriver  
Trimming knife  
Long nose VDE pliers  
Side cutters

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### Materials

Pipe freezing spray  
Suitable fixing tape or cable ties  
Self-adhesive foil tape

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### Equipment

Items required on the Permit to work  
Electric current measuring instrument (ammeter)  
Voltage measuring instrument  
Insulation resistance measuring instrument, minimum 500V output

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## Commissioning

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Commissioning tasks comprise:

- switching on the power to each trace heating system.
  - all the tasks described in the *Testing and Inspection* section below.
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Power supply system	<p>Check and record that each trace heating system is protected by a type C or D breaker and RCD.</p> <p>Check and record that each trace heating system's power supply is rated and installed:</p> <ul style="list-style-type: none"><li>• with regard to the trace heating Test and Completion certificate.</li><li>• in accordance with applicable local electrical installation regulations.</li></ul>
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Power supply local isolator	<p>Check and record that each trace heating system's local power supply isolator is unfused. If the local isolator contains a fuse, the isolator should be changed to an unfused type. If the isolator is changed, the wiring between the isolator and the <i>TraceStat</i> may need to be upgraded.</p>
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## Testing and Inspection

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Tests and inspections (Ts&Is) of each *FreezCheck* system should be performed regularly by a competent person, at sufficiently frequent intervals, so as to afford little chance for the system to become impaired or dangerous between times. The recommendations below are not exhaustive and applicable local electrical installation regulations prevail.

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Visual, physical	<p>Check and record that the thermostat appears to be sound. There should be no signs of water ingress or physical damage. The lid should be fastened uniformly and tight.</p> <hr/> <p>All cable gland entries to the <i>TraceStat</i> and any <i>JB420B</i> junction boxes must be steadfast. Each gland body must be air-tight flush to the side wall of each enclosure. <i>FreezCheck</i> cable glands do not require a sealing washer. Each gland seal must be suitable for the diameter and cross-section shape of the cable passing through it. If a cable can be easily hand-pulled out of the gland seal it will not be water-tight. If a cable creates an undue cantilever load on its gland it may impair the water-tightness of the gland body at side wall of the enclosure.</p> <hr/> <p>Check and record that every <i>FreezCheck</i> cable connecting to each <i>TraceStat</i> and <i>JB420B</i> does not have a damaged jacket - the cable's outer insulation. The braid beneath the jacket should not be visible. If the damage extends into the inner insulation beneath the braid, consider isolating power to the trace heating system until the damage is repaired.</p> <hr/> <p>Check and record that caution labels are affixed to the pipe insulation - to warn others that electric trace heating is fitted beneath the insulation. Placement should be no more than 6 metres apart on pipe and should be on or very near maintainable equipment such as valves and pumps.</p> <hr/> <p>Inspect all visible pipe insulation for damage and continuity. If and where it is damaged, check the trace heating beneath for damage by carefully removing a section of the damaged pipe insulation. If the trace heating cable is not damaged, immediately renew or repair the damaged pipe insulation. The effectiveness of fibrous insulation will approximately halve after it has become saturated and for all intents and purposes it will not dry out unaided.</p>
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Heater inner insulation testing	<p>Switch the trace heating system's local isolator to 'OFF'. Lock off if appropriate.</p> <hr/> <p>After the <i>TraceStat</i> display extinguishes, detach the lid to access the internals. Set the insulation resistance tester to 500V output and select the 200M<math>\Omega</math> range. Perform an insulation resistance test between the blue neutral terminal and the yellow earth terminal. The measurement should be greater than 200M<math>\Omega</math>, however measurements of 5M<math>\Omega</math> and greater achieve a 'pass'. Before each test, touch the two test lead probes together to make the tester measure zero resistance and thus confirm that the test leads are connected to the test instrument correctly. Discharge the <i>FreezCheck</i> cable(s) after each test.</p>
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## Testing and Inspection (cont'd)

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Heater inner insulation testing (cont'd)	If the insulation resistance test indicates a fault, determine if the fault is in the trace heating system. Remove the <i>FreezCheck</i> cable's earth braid from the yellow earth terminal and re-perform the test between the blue terminal and the un-terminated earth braid. If the test does not indicate a fault, the trace heating system has passed the test. If the test indicates a fault and there is more than one heater radial connected to the <i>TraceStat</i> , separate the earth braids and re-perform the test between the blue terminal and each earth braid to determine which radial contains the fault.
	Record the 'pass' measurement if applicable, replace any removed earth braid and replace the lid if no further tests are to be performed.
Power supply confirmation	Switch the trace heating system's local isolator to 'ON'.
	Check and record that the <i>TraceStat</i> displays measured temperature.
Energised <i>FreezCheck</i> cable testing	There are two methods to energise <i>FreezCheck</i> when the <i>TraceStat</i> is not calling for heat.
	<u>Method 1 - cool the temperature sensor</u> Remove pipe insulation to reveal the temperature sensor which will be at the end of a 2.8m lead wire. Apply freeze spray to the sensor until the <i>TraceStat</i> switches the trace heating on. The <i>TraceStat</i> will initially display rapidly falling temperature while the spray media evaporates. If the test is on an active hot water service or heating water pipe, the temperature probe will need to be detached from the pipe to eliminate any undue warming influence on the temperature probe.
	<u>Method 2 - force switch power</u> If the temperature sensor cannot be accessed, the contactor can be manually actuated. At the top of the contactor's cover plate there is a small push lever. When it is moved downwards, the contactor will switch power to the trace heating. The lever pushes against a spring so it will need to be manually held in place for the duration of the test. Use of a hand-held VDE rated flat-head screwdriver is recommended.
	Check and record that after about one minute from switch-on, all <i>FreezCheck</i> cables connecting to the <i>TraceStat</i> are warm to the touch.
	Check and record that all <i>FreezCheck</i> cables connecting to all <i>JB420B</i> junction boxes are warm to the touch..
	After about one minute, check that current flow is greater than 0.5 Amps and record. Usually, this test can only be carried out on live power supply conductors within an enclosure such as a distribution board, local isolator or trace heating thermostat; competency and a permit to work may be required to perform this test.
	If possible / practicable, check that the ends of all <i>FreezCheck</i> radials are warm. Carefully remove the pipe insulation and detach the last 500mm - approximately - of <i>FreezCheck</i> from the pipe so that its intrinsic temperature is not influenced by the pipe temperature. Re-instate the <i>FreezCheck</i> and the pipe insulation afterwards.
	When the testing is completed, ensure that the <i>TraceStat</i> contactor's manual actuation push lever is in its normal position before replacing the lid.

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## Operation

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The trace heating system will ensure that the piping it is protecting will not freeze.

*FreezCheck* is usually applied to all piping that has the potential to be exposed to ambient temperatures below 0°C and to all piping that has the potential to be in a 'no-flow' scenario - such as a dead leg, or when there is no demand or the process has stopped or shut down. Generally, a trace heating system will not freeze-protect a piping system that is flowing. A pipe containing flowing water being continually replaced by water warmer than 0°C will not freeze if the flow rate is high enough.

The *TraceStat* thermostat energises *FreezCheck* cable when it measures 3°C pipe temperature during falling temperature. It will keep *FreezCheck* energised until it measures 5°C during rising temperature, at which point it will de-energise the cable. Mains power connects to the trace heating system at the *TraceStat*.

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## Operation (cont'd)

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A trace heating system's performance is dependent upon its pipe insulation's performance.

In some installations, wiring is connected between the *TraceStat* and a Building Management System to convey a volt-free binary fault signal. The signal circuit is normally closed when the *TraceStat* is energised. The fault condition is therefore open circuit - fail safe.

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## Problem Solving

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Symptoms	Causes - possible and probable	Suggested Remedies
<i>TraceStat</i> display is not illuminated	Power not being received by the <i>TraceStat</i> .	<p>Check the power supply thoroughly. If the 'power on' indicator lamp on the local isolator face plate is not illuminated, then no power or insufficient power is being conveyed to the thermostat.</p> <p>If a fuse is being used between the power supply source and the <i>TraceStat</i>, the fuse may have blown. The spur may need to be changed to an unfused type and the wiring between the isolator and the <i>TraceStat</i> may need to be upgraded.</p> <p>Check that the type and rating of the breaker at the power source is equal to or higher than that stated on the trace heating <i>Installation And Completion Test Certificate</i>.</p> <p>Check that the power wiring terminations inside the <i>TraceStat</i> are proper and have not loosened. To access the internal terminals, detach the <i>TraceStat</i> lid.</p>
The lid corners of the <i>TraceStat</i> appear to contain moisture	Water has ingressed to a lid screw chamber.	No remedy needed because each lid screw chamber is outwith the lid's weatherproofing seal.
<i>TraceStat</i> contains water	The lid is not tightened down properly.	Detach the lid and remove all traces of water after having fully isolated and locked off the power supply wiring. Re-commission the trace heating system. See aforementioned ' <i>Commissioning</i> '.
	One or more cable entries are not installed correctly. 'Pin-holes' at the gland aperture in the side wall are allowing moisture ingress. See aforementioned ' <i>Testing and Inspection – Visual - Check and record that the thermostat is sound</i> '.	<p>Ensure that cables connected to the <i>TraceStat</i> are not 'pulling' on their respective cable glands.</p> <p>Ensure cable gland bodies cover the whole of the gland aperture.</p> <p>If necessary, replace glands, remove all traces of water. Re-commission the trace heating system. See aforementioned '<i>Commissioning</i>'.</p>
Fuse in local isolator blows when the <i>TraceStat</i> energises the <i>FreezCheck</i>	Incorrect local isolator type.	<p>Change the isolator to a suitable unfused type. The wiring between the isolator and the <i>TraceStat</i> may need to be upgraded.</p> <p>Check that the type and rating of the breaker at the power source is equal to or higher than that stated on the trace heating <i>Installation And Completion Test Certificate</i>.</p>

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## Problem Solving (cont'd)

Symptoms	Causes - possible and probable	Suggested Remedies
RCD and / or power supply main breaker trips instantaneously when the <i>TraceStat</i> energises the <i>FreezCheck</i>	Short circuit caused by moisture in the thermostat.	See aforementioned ' <i>Problem Solving - Thermostat contains water</i> '.
	Damage to the <i>FreezCheck</i> cable.	Perform the test prescribed in the aforementioned <i>Testing and Inspection - Heater Inner Insulation Testing</i> . If the trace heating fails the test and there is more than one <i>FreezCheck</i> cable terminated at the <i>TraceStat</i> , systematically prove each radial of <i>FreezCheck</i> until the damaged radial is identified. 'Walk' the trace heating route to check for obvious signs of damage to pipe insulation and exposed <i>FreezCheck</i> cable. Contact <i>Traceheaters Limited</i> to arrange for the repair. 01483 825193
	Short circuit in the power supply wiring.	Perform the test prescribed in the aforementioned <i>Testing and Inspection - Heater Inner Insulation Testing</i> . If the trace heating passes the test the problem is within with the power supply.
RCD trips when trace heating system is switched on	Intelligent RCD has not been commissioned.	Possible change of wiring configuration in the local isolator. Commission intelligent RCD then re-commission trace heating system.
Power supply main breaker trips after a few seconds delay when the <i>TraceStat</i> energises the trace heating system	Incorrect breaker.	Check that the type and rating of the breaker at the power source is equal to or higher than that stated on the trace heating <i>Installation And Completion Test Certificate</i> .
	Low resistance between the <i>FreezCheck</i> conductors caused by build up of moisture in the thermostat.	See aforementioned ' <i>Problem Solving - Thermostat contains water</i> '.
Lower-than-expected insulation resistance test measurement	Gradual moisture ingress and / or damage to the trace heating.	Compare the measurement with that from the last inspection. If the insulation resistance has reduced since, but the new measurement is above 5M $\Omega$ , the system is safe to use. However it should be further inspected soonest to ensure that the resistance will not reduced to any value below 5M $\Omega$ . If the insulation resistance is below 5M $\Omega$ the fault should be rectified.
No insulation resistance when tested	Power supply is interfering with the test measurement. Insulation resistance test indicates zero resistance or earth fault.	Fully isolate and lock off the power supply wiring. Detach the live and neutral power supply conductors and earth conductor from their terminals in the thermostat and re-perform the test.

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**Problem Solving** (cont'd)

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Symptoms	Causes - possible and probable	Suggested Remedies
<i>FreezCheck</i> cable is visibly damaged	Accidental damage or rodent activity.	Contact <i>Traceheaters Limited</i> to arrange for the repair. 01483 825193
BMS shows trace heating alarm	No power to the trace heating system.	Re-instate power supply.
	BMS is interpreting an open circuit as healthy.	Reconfigure the BMS input signal so that an open circuit is unhealthy.
	Pipe temperature is too low. ( <i>TraceStatX</i> and <i>TraceStatX42</i> models only)	The trace heating has not been energised. Manually energise the trace heating until an acceptable pipe temperature is displayed. The factory setting for low temperature is 1°C.
	Pipe temperature is too high. ( <i>TraceStatX</i> and <i>TraceStatX42</i> models only)	Investigate the process. The factory setting for high temperature is 85°C - the upper withstand limit for <i>FreezCheck</i> . The cable could be damaged. ©

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