I-GON^3

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Instructions for Use

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Borehole Maintenance and Record Keeping

It is important to keep good records of the borehole and pump performance. In particular details of the installed equipment must be retained: pump model and type, rated flow, generated head & set depth. This information is important to avoid guesswork when there is a failure and the pump needs replacing.

Pump flow rates, running current, standing and pumped water levels should be monitored every six months and records kept. A drop off in flow can be caused by a damaged pump or contamination in the borehole, a high motor current can indicate problems with the pump and a drop off in the pumped water level might suggest that the casing/screen and or aquifer are becoming blocked rather than just a natural lack of groundwater.

These issue should be dealt with before the pump / system fails completely. It is a lot cheaper to rehabilitate a borehole than to drill a new one.

Iron and Manganese in Groundwater

Iron (& manganese) related bacteria occur naturally in aquifers in many areas of the world and, while they are harmless to humans and livestock, they can play havoc with a borehole and its pump etc.

Aerobic bacteria like areas of high oxygen in a borehole, ie., high velocity areas of a screen during pumping or at the static water level, cascading water, etc. Iron bacteria (Biofilm) thrive in an iron-rich environment: each bacterium produces a stalk or tube like, sheath which becomes a framework that slime bacteria attach to or fill in. Iron bacteria also like areas of high nutrients, ie. steel casing, pumps or decayed debris from other bacteria. They secrete a very corrosive enzyme to process nutrients so corrosion is often found on metal surfaces.

Surface Symptoms

The contamination will take the form of rust-red deposits which will gradually block pump impellers and waterways, together with any rigid piping within the well system and downstream. This causes a reduction in flow due to reducing bore and increased surface friction. So while the tell-tale signs will confirm the presence of bacteria when a pump is lifted from the bore, diminishing flow from the system in-situ will have suggested that iron fouling could be a problem. Other indications may include musty or fishy odours and even an oily film on water. The most common families of iron bacteria are Galleonella, Crenothrix, and Leptothrix.

A brown / black colouration to the contaminant will indicate the presence of Manganese Oxide contamination which is similar to Iron Oxide contamination in most respects – and will generally occur in conjunction with it. Manganese will not be mentioned separately hereafter in these notes and all references to Iron and its treatment can be taken as referring to Manganese equally.

If water from the pump appears to be crystal clear yet takes on a brown tinge after standing for a while, it contains dissolved ferrous (Fe2+) salts which are oxidising to the insoluble ferric (Fe3+) form. With less oxygen available below ground this process will be very gradual at the level of the pump but a hard, rusty, layer will slowly build on hard surfaces and start to choke waterways.

Should the water be rusty & cloudy looking on start-up and have an unpleasant smell there will be Iron Related Bacteria in the borehole. These grow as an orange slime while also oxidising the ferrous salts into ferric solids which will, again, cause acute blockage of the water passages.

Each borehole is, of course, different but many iron affected wells will suffer both direct oxidation & bacteriological contamination to some degree.

Treatment for Iron Bacteria and Manganese

Being endemic in the environment, nothing can be done to permanently eliminate such bacteria from your borehole. **I-GON^3** can be used to rid the system of bacteria periodically but they will return: only experience of your particular well will show how frequently treatment has to be repeated.

Needless to say, when treating a well infested with bacteria, it's important that the pump set, submersible cable and any other down-hole items are chemically cleaned before reinstallation so they don't reintroduce the problem. Moreover all drilling or test pumping equipment used on any site must be sterilized before relocation to avoid any risk of bacterial contamination on the next project.

I-GON^3 Description

I-GON^3 is supplied as a crystalline powder containing a powerful, naturally occurring, chemical which will combine with the Iron Oxide deposits to form a solution which can be pumped from the borehole. **I-GON^3** will not react with or damage any metallic or man-made material generally used in borehole pumps or pumping systems. **I-GON^3** is totally biodegradable and safe for disposal once neutralized.

Available from stock in re-sealable 10kg plastic tubs, **I-GON^3** can be supplied in smaller quantities or in bulk if required.

Setting up the Site

Cleaning the borehole can take up to 24 hours depending on the severity of the contamination so an appropriate time slot must be identified beforehand.

The pump should be turned off and isolated electrically before carrying out any modifications to the system. There's no need to remove the pump from the well but it may be necessary to disconnect and raise the headworks, with a crane or other lifting tackle, to gain access to the top of the borehole. (Ideally an access port will have been provided in the wellhead but this is rarely the case.)

Provision should be made to recirculate the water (**I-GON^3** solution) from the wellhead back into the top of the borehole during cleansing rather than discharging by the normal route – this can be by flexible hose from a convenient pipe joint or by purpose-made connection. (Any of the normal pipe run incorporated in this circuit will, of course, benefit from the cleansing action of the solution.)

At the primary rinsing stage the reaction product will be flushed from the borehole so an effluent tank must be provided to receive this, capable of taking 5 or 6 times the water capacity of the well.

Occasionally, the use of **I-GON³** can dislodge loose material above the pump and this can cause difficulties in withdrawing the unit. Raising the wellhead from the ground slightly before applying the chemical will allow the pump to be worked up and down later in order to ease any blockage.

Cleaning the Borehole

I-GON³ should be fed directly into the bore, either in its dry form or, ideally, as a slurry. This can be achieved by using a 1000 litre IBC or plastic tank through which the pump can be piped and the solution allow to syphon back down the borehole. (See below for the appropriate dosage for each well.) While the **I-GON³** is introduced to the system, the pump should be run to recirculate the resulting solution through the wellhead and back into the borehole. After running for approximately an hour, to ensure all surfaces are treated, the pump can be turned off, the tank allowed to fully drain and the solution left to act for 24 Hours.

I-GON³ Dosage

At ambient temperature **I-GON³** is most effective when used at about 5% solution so the following dosing guide will give an indication of the quantity required for a range of boreholes : -

Bore Diameter		2" 50mm	3" 75mm	4" 100mm	5" 125mm	6" 150mm	8" 200mm	10" 250mm	12" 300mm
Water Depth	30' / 10m	1kg	2kg	4kg	6kg	9kg	16kg	25kg	35kg
	60' / 20m	2kg	4kg	8kg	12kg	18kg	31kg	49kg	71kg
	100' / 30m	3kg	7kg	12kg	18kg	27kg	47kg	74kg	106kg
	130' / 40m	4kg	9kg	16kg	25kg	35kg	63kg	98kg	141kg
	160' / 50m	5kg	11kg	20kg	31kg	44kg	79kg	123kg	177kg
	200' / 60m	6kg	13kg	24kg	37kg	53kg	94kg	147kg	212kg
	260' / 80m	8kg	18kg	31kg	49kg	71kg	126kg	196kg	283kg
	330' / 100m	10kg	22kg	39kg	61kg	88kg	157kg	245kg	353kg
	400' / 120m	12kg	27kg	47kg	74kg	106kg	188kg	295kg	424kg
	500' / 150m	15kg	33kg	59kg	92kg	133kg	236kg	368kg	530kg

Rinsing

Primary Rinse : After soaking for 24 hours (by which time reaction will be complete) reconfigure the pipework to divert most of the water to the effluent tank and re-start the pump. Run it until all the **I-GON³** solution - by now a green turbid liquid - has been flushed and the water runs clear. Then divert the flow of clear water back down the well for 5 minutes rinsing the casing above the pump. Repeat this rinsing twice then continue pumping to waste.

Secondary Rinse : Once the water runs clear, divert the flow to waste ground or other approved clean water disposal facility and continue to run the pump for two hours.

Neutralization & Disposal / Environmental Impact of I-GON³

If the correct dosage has been used the **I-GON³** treatment should have resulted in an effluent tank full of near-neutral bio-degradable oxalate solution which can be disposed of within the guidelines of the relevant water service company or Environment Agency, as appropriate. Any residual acidity can be treated with **I-GON Neutraliser**, in accordance with instructions provided, prior to disposal.

Neither **I-GON³** nor its reaction products will remain within the borehole system in measurable quantities if rinsing instructions are followed correctly.

I-GON Test Kits

Two test kits are available, the **I-GON** Cleaner pH Test Strips (Supplied with all **I-GON**) and the more comprehensive Residual **I-GON** Drop Test Kit. (Available to purchase)

Both are used to test the level of **I-GON³** present in the water during and after treatment – specifically during the rinsing phase.

A water sample should be taken prior to treatment of the borehole and compared with a sample taken on completion – but prior to flushing. A slightly lower final pH figure will show traces of acid remaining and confirm that all iron oxide contamination has been removed. (An exact pH match would simply indicate that the **I-GON³** is fully exhausted and it could be that the treatment is unfinished if too low a dosage had been used.)

Problems after Cleaning

- **Recurrence of Contamination : I-GON³** is not a 'Miracle Cure' and the contamination will reappear in the borehole as it is an entirely natural process. Experience will dictate the frequency of treatment necessary to keep the problem in check with a minimum of down-time.
- **Riser Porosity :** Steel risers (& other downstream pipework) will suffer from corrosion over time and may rust through entirely to cause minor leakage holes – removal of the surrounding oxide layers with I **I-GON³** will reveal the true severity of the problem and can increase leakage. Unless the bore is sufficiently large for a CCTV survey the only way to check for this problem is to lift the riser for inspection. Care should be taken as severe corrosion could have weakened the steel leading to a danger of losing the pump in the bore.

Safety Precautions

I-GON³ is supplied as a crystalline **powder** containing an organic **acid** so should be treated with the appropriate caution.

Whilst **I-GON³** is in its dry state an operative should wear a dust mask & close-fitting goggles or helmet-mounted visor together with acid-proof gloves. Extreme care should be taken to avoid any contamination of other exposed areas of skin, hair or clothing - especially in windy conditions. To avoid splashes when recirculating the freshly prepared solution a waterproof suit and boots should be worn in addition.

As with all chemical handling it is better to look a fool wearing too much protective equipment than to assume the substance is as innocuous as it looks and suffer the consequences later.

In rare cases, where the borehole is in a very confined space, **carbon dioxide** released during **I-GON³** reaction could build up to a potentially dangerous level so measures should be taken to artificially ventilate any such enclosed area – air quality should then be monitored continuously.

Site conditions may, of course, impose specific hazards to anyone working at a particular location so personnel should endeavour to ensure that they are cognisant of potential risks at all times. (Proquip Direct Limited cannot be held responsible for any accident or injury resulting from the misuse of **I-GON³** products outwith the guidance offered in these Instructions for Use - nor for any accident or injury, howsoever caused, not directly related to the use of said products.)

General Safety

Harmful if swallowed.
Harmful in contact with skin.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash thoroughly after handling.
Do not eat, drink or smoke while using this product.
Call a poison centre or doctor if you feel unwell.
Remove contaminated clothing and wash before use.
IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.
IF ON SKIN: Wash with plenty of soap and water.

Following skin contact
Carefully and gently brush the contaminated body surfaces in order to remove all traces of dry product for at least 15 minutes. Wash affected area immediately with plenty of water if a liquid contamination. Remove contaminated clothing. If necessary seek medical advice.

Following eye contact
Rinse eyes immediately with plenty of water for at least 15 minutes and seek medical advice.

After ingestion
Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Obtain medical attention.

Use **I-GON³** for boreholes or our alternative product **I-GON²** for cleaning components .

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