ARMATEC Handbook
Third Edition

Fibreglass Products for Drainage Systems

Trade Waste & Sewage

ARMATEC Environmental Ltd

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ARMATEC Contact Details

Contact one of our five chemical engineers listed below. You are welcome to visit our factory in New Plymouth, where you can meet with Kevin, Dominic and Todd. Maarten and Ken are based in the Auckland area.

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Welcome

Third Edition: November, 2011

The third edition of this handbook is an update of our popular 2009 edition. ARMATEC's products include fibreglass piping, manholes, pump stations, odour filters, flumes, coatings and linings, tanks, vortex droppers, and more; everything you might need for trade waste and municipal sewage drainage projects. Many customers like our total product range, which eliminates the difficulties interfacing various suppliers and different materials.

Most of our products are fabricated in corrosion resistant fibreglass at our New Plymouth factory, in New Zealand. We have been manufacturing fibreglass at this site since the 1970s, and we are New Zealand leaders in this field. Our team of chemical engineers and tradesmen can make almost anything you can conceive. Properly manufactured fibreglass products will have an indefinite life in wastewater applications.

This handbook includes detailed information on the properties of fibreglass, the products themselves, applicable standards, quality assurance, how to handle fibreglass, and case histories. It has become a reference resource that I carry at all times; I hope you find it as valuable.

Ken Holyoake
Managing Director of ARMATEC Environmental Ltd
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PS: Please take advantage of the resources on our website, including technical bulletins, engineering information, and project summaries.

www.armatec.co.nz

'Products', the Home Page

Our home page. Click on the subheadings, eg 'Fibreglass Products' to go to pages that include technical bulletins on fibreglass pipes, sumps, manholes, pumping stations etc. Alternatively use the product submenu to go directly to information on that product. Fast and easy to use.

'Free Information' A valuable resource

Information and technical papers on fibreglass, engineering and our company. Most articles have been prepared in response to customer questions. For example, there is an article on 'Handling Fibreglass Vessels' that transport operators and installation personnel will find useful.

'Projects' What we have done

Information on significant projects undertaken by ARMATEC. Some include pdf files with photos and information. ARMATEC can supply additional information on any of these projects on request.

Products & Services

PRODUCT	RANGE	OPTIONS
Pipes	100, 125, 150, 200, 225, 250, 300, 350, 400, 450, 500, 610, 760, 818, 910 diam Pipe, elbows, tees, wyes, flanges, floor traps	SN1250, SN2500, SN5000, SN10,000 Pressures to 10 bar
Manholes	610, 760, 818, 910, 1070, 1200 diam With anti-flotation rings, inlets, outlets Depths to 5 metres typical	Access ladders Different lid styles Sealed sewer style
Pump Stations	1070, 1200, 1480, 1830, 2000, 2400, 2800, 3050, 3500 diam Supplied with complete factory fit out Supplied in conjunction with Xylem (ITT)	Different lid styles Flygt TOPS bases
Valve Chambers	To match pump stations 50, 75, 100, 150 diam valve sets	Round Rectangular
Odour Filters	Green Dome™ Odour Filters - for pump stations and air release valves Carbon bed adsorbers for low H_2S conc. Biological scrubbers for higher H_2S conc.	
Flumes	Trapezoidal, Parshall, Palmer Bowlus All flow ranges	Integral manhole
Vortex Droppers	Custom designed for each project Abrasion resistant inner surface	
Tanks	1830, 2000, 2400, 2800, 3050, 3500 diam. Vertical with flat base and domed top Horizontal with domed ends Inlet, outlet, drain, vent, top manhole Lifting lugs and seismic hold down	Access ladders Custom nozzles Platforms Handrails
Coatings & Linings	Vinyl ester and moisture epoxy coatings Armaline moisture tolerant epoxies Barrier technology for lowest permeability	Full installation or materials only
Site Installation	Butt and strap jointing	
Training	Butt and strap jointing	In factory or on site

All available from one source

For pricing information contact ARMATEC. Detailed bulletins for most products are available on our website www.armatec.co.nz. Lead times typically four to six weeks after drawings 'Approved for Construction' by the client.

Why Fibreglass?

Fibre reinforced plastic (FRP) composites are an engineered combination of fibres (usually glass) for strength, and a matrix of thermoset resin that both binds the fibres and protects them from the chemical environment. By selecting the right combination of resin and fibres, the designer and manufacturer can create a product or part, that meets the most demanding specification.

Corrosion Resistant

Fibreglass has excellent resistance to many chemicals; subject to the correct resin choice:

- **Vinyl ester** resin is the best choice for trade waste drains as it can handle acids, alkalis and bleach solutions.
- **Isophthalic polyester** resin is the preferred choice for standard sewers.

Light Weight

Handling, transport, lifting, and installation are all simplified with the light weight of fibreglass. Usually the same digger used for excavations can be utilised for lifting and placing our products.

Smooth Internal Surface

Smooth internal surfaces facilitate cleaning and provide low friction loss.

Weather Resistant

As fibreglass is corrosion resistant on both the outside and inside, there is no need for any further protection or painting.

Leak Free Joints

Standard fibreglass butt and strap joints are leak free and stronger than the original material. Infiltration and leakages are eliminated.

Easy To Modify

On-site modifications and additions are easy to do; simply cut with hand tools, then butt and strap anywhere at any time.

Versatile

Anything can be made with fibreglass. Challenge us with your ideas and requirements. Fibreglass is ideal where there are complex curved surfaces, and when a number of identical products are required. The external surface can be pigmented to a colour of your choice, eg to identify a particular drain line.

Standards & QA

International standards for design and fabrication, and associated quality assurance procedures are well established. ARMATEC is ISO 9001 accredited with BVQI as the auditing body.

Low Life Cycle Cost

Fibreglass has a low life cycle cost in comparison with other materials. The initial installed cost is often similar, but fibreglass has an indefinite life in drainage systems, with minimal maintenance and cleaning required. There is no need to replace the fibreglass at regular intervals.

Proven Performance

Corrosion resistant fibreglass evolved in the chlorine and acid solutions of pulp and paper mills, and is now a proven performer across all industries.

ARMATEC's first dairy industry fibreglass manhole was installed in 1988, and is still in service today.

Properties of Fibreglass

Contact Moulding Process

Contact Moulded Fibreglass

All ARMATEC fibreglass products are made by the contact moulded hand lay-up process for maximum chemical resistance. The resin gives a fibreglass laminate its chemical resistance; the more resin the better the chemical resistance. Contact moulding achieves the highest resin to glass ratio of 70:30, compared to alternative manufacturing methods.

Contact moulding uses mainly non continuous fibre reinforcing, in the form of fibres cut to about 50mm in length. This ensures chemicals cannot track far along the glass fibres, limiting the spread of chemicals if the fibreglass laminate is damaged, or the end of a laminate is left exposed. This is particularly important for smaller diameter pipe systems when it is not possible to strap internal joints, and cut ends of pipe are left exposed to the chemicals.

The contact moulding process is mechanised with chopper guns that can apply chopped glass and resins simultaneously, and with moving moulds to speed the processes. It is ideal for short run production, or custom items.

Complex Shapes

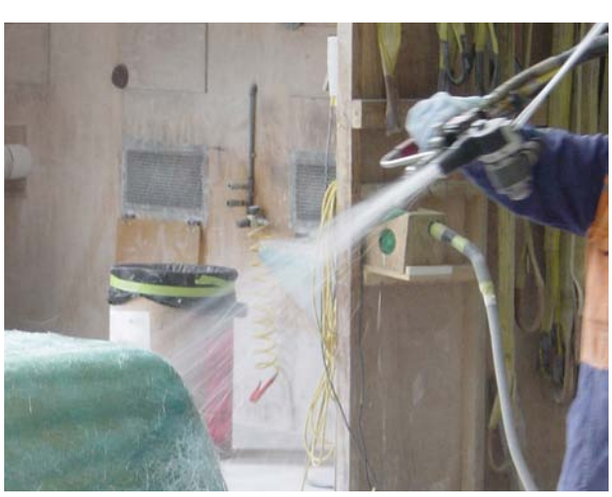
Complex shapes, elbows, and other pipe fittings are manufactured by the contact moulded method. Butt and strap field joints are done by the contact moulded process.

Surface Reinforcement

The internal and external surfaces of all laminates are reinforced with a layer of fine surfacing tissue. This gives these resin rich layers added strength to better handle stresses including those from chemicals and thermal shock.

Contact moulding: applying resin to the glass mat reinforcing (CSM - chopped strand mat).

Consolidating the laminate with a ribbed roller to remove air bubbles and achieve physical properties.



Chopper gun simultaneously applying chopped glass fibre and resin to a mould.

Properties of Fibreglass

Physical Properties

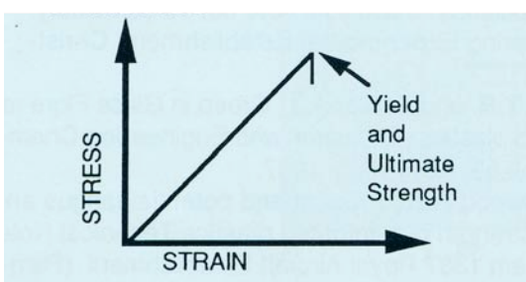
Typical Physical Properties: 10mm Contact Moulded Laminate

Specific Gravity	1.5
Linear Coefficient of Thermal Expansion	27 x 10-6 m/m-degC
Thermal Conductivity	1.5 W/m-degK
Glass Content	30 - 35%
Barcol Hardness	35 to 45
Ultimate Tensile Strength	103 MPa
Flexural Strength	152 MPa
Compressive Strength	152 MPa
Elongation to Failure	2%

Specific physical properties are dependent on wall thickness, laminate construction, and resin selection. Contact ARMATEC for detailed information and advice. Note: Numbers given should not be construed as a specification.

Stress-Strain and Creep

Yield and ultimate strength for fibreglass occur at the same point in the stress/strain curve, so that failure is sudden once the ultimate strength is reached. This is why the fibreglass mast of Team New Zealand's yacht failed so dramatically during an America's Cup race.

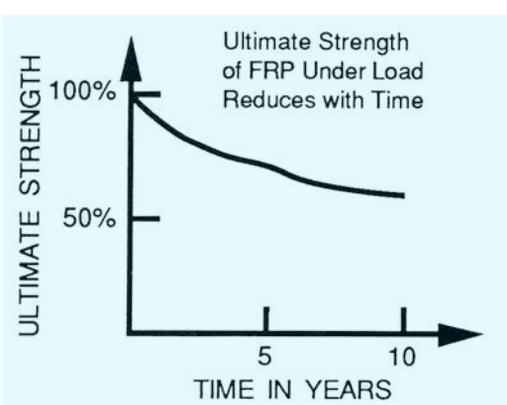


Stress/strain curve for fibreglass.

Fibreglass is also a plastic material and is subject to creep; for constantly loaded fibreglass, the ultimate strength reduces by about 50%.

Design Safety Factors

As a direct result of the above properties, design safety factors used with fibreglass generally range from 3 to over 10. The lower range is for occassionally loaded parts like drainage pipes, whereas the higher numbers are for constantly loaded parts such as pressure pipes. This keeps the design point on the stress/strain curve well away from the yield point. These safety factors are specified in standards, and have been developed from experience and the analysis of past failures in actual installations. The relatively high safety factors used enable fibreglass to better survive unexpected and one-off loads.



Creep curve for constantly loaded fibreglass.

Properties of Fibreglass

Resin Selection

Chemical Resistance and HDT

Chemical resistance and HDT (heat distortion temperature) are the two key properties when choosing the resin for a specific application. It is good practice to choose a resin that has a HDT of 20ºC more than the maximum operating temperature.

Isophthalic Resins

The main fibreglass resin used for standard municipal sewers is isophthalic polyester. It has excellent resistance to immersion in water and dilute chemicals, and a HDT up to 100ºC. It is easy to use, fast curing, and low cost. Important note: it has a weakness in alkali solutions.

Vinyl Ester Resins

The second main fibreglass resin used is vinyl ester resins. They are known for their outstanding chemical resistance to strong acids, alkalis and oxidising agents. Vinyl esters have HDTs from 100ºC to over 120ºC. Vinyl ester resins also have excellent flexibility, making them ideal if large fluctuations in temperature occur.

Chlorendic Polyester Resins

These special resins are characterised by their unique chemical resistance to strong oxidising chemicals.

Fire Resistant Resins

Resins are available with low fire spread characteristics, with some even self-extinguishing (when flame is removed from fibreglass, the fire self-extinguishes).

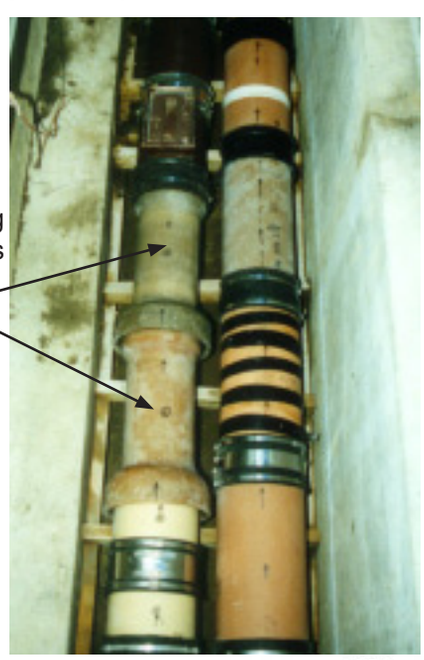
High HDT Resins

Resins are available with HDTs up to 150ºC. These resins are used for high temperature waste streams, and where the installation is in geothermal areas.

High temperature fibreglass pipe installed through geothermal area.
Contract and photo by Hydrus Engineering Consultants.

NZDRI Testing 1992-4

A range of materials for the handling of CIP wastewaters were tested by the NZ Dairy Research Institute. The test report TS94R12 stated the ARMATEC FRP samples "appear to be completely unaffected", and, "appeared to have excellent resistance to the dairy wastewater". The report continued ... "many of the ceramic pipes that were readily available in New Zealand had softened significantly since installation".



NZDRI test rig FRP test spools by ARMATEC

Properties of Fibreglass

Chemical Resistance Data

FRP resists a wide range of chemicals depending on resin selection:

- **Vinyl ester resin for trade waste drains**
- **Isophthalic polyester resin for sewers.**

Materials	Carbon Steel 1020	Stainless 316	FRP Isophthalic	FRP Vinyl Ester
Acetic Acid	NR	R	NR	R
Acid Chloride Salts	NR	NR	R	R
Bleach	NR	NR	NR	R
Chlorine Wet	NR	NR	NR	R
Chlorine Dioxide	NR	NR	NR	R
Hydrochloric Acid Dilute	NR	NR	R to 5%	R
Hydrochloric Acid Conc	NR	NR	NR	R
Hydrofluosilicic Acid	NR	NR	NR	R
Hydrogen Sulphide	NR	NR	R	R
Lactic Acid	NR	R	R	R
Nitric Acid Dilute	NR	R	R to 5%	R to 40%
Nitric Acid Conc	NR	R	NR	NR
Phosphoric Acid Dilute	NR	R	R to 5%	R
Phosphoric Acid Conc	NR	R	NR	R
Salt Water	NR	NR	R	R
Sodium Hydroxide Dilute	NR	R	NR	R
Sodium Hydroxide Conc	R	R	NR	R
Sodium Hypochlorite	NR	NR	NR	R
Sulphuric Acid Dilute	NR	R to 5%	R	R to 75%
Sulphuric Acid Conc	R	R	NR	NR

R = Resistant, NR = Not Resistant. Consult ARMATEC for more detailed information.
For example there are temperature limitations to almost all the data given above.
Consult ARMATEC for chemical resistance to other chemicals.

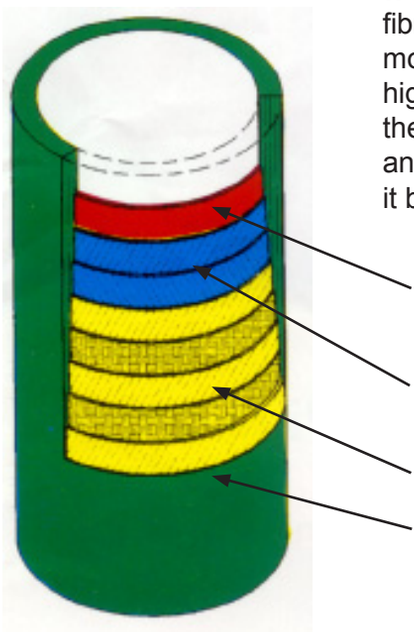
Note: For sewers, the temperature of the fibreglass is not always the maximum temperature of the liquid or chemicals entering the system. The temperature in the sewers will be lower due to other cooler liquids entering and cooling the hottest liquids, and the ground has a cooling effect on the pipes. Also temperature spikes are often relatively short in duration.

Fibreglass Pipe Systems

Contact Moulded Manufacture

ARMATEC

Pipe Cross Section



Industry Standard for Best Chemical Resistance

Fibreglass laminates made by contact moulding, also called hand lay-up, have the highest resin to glass ratios of 70:30 when compared to alternative manufacturing methods. As it is the resin that gives a fibreglass laminate its chemical resistance, this high ratio makes contact moulding the preferred fibreglass manufacturing process when the highest degree of chemical resistance is required. In contact moulding, the main laminate is reinforced mainly with non-continuous glass fibre, and this limits the spread of any chemicals within the laminate should it be exposed or damaged.

Inner Surface. The interior surface 0.25mm - 0.5mm, is a smooth resin rich laminate reinforced with surface veil. This provides optimum corrosion-resistance and a minimal friction factor when combined with the best resin for the specific chemical conditions.

Next Interior Layer. PIpes in all diameters are manufactured with an additional chemical resistant liner at least 2.5mm in thickness in the form of chopped strand mat, critically limiting chemical permeation.

Remaining Thickness. Subsequent reinforcing layers of woven roving and chopped strand mat are used to build the laminate to the desired thickness.

Exterior Surface. The final layer provides protection against weathering, fumes, spillage and ultraviolet attack. This gives the pipe a longer life and reduces maintenance expenses.

The Importance of Contact Moulded Manufacture

After 11 years in service at temperatures fluctuating from 20ºC to 95ºC within seconds, the interior surface of the fibreglass pipe made from contact moulding has crazed from thermal shock, but the pipe remains structurally sound. The high resin to glass ratio (70:30), the non-continuous reinforcing fibres, and the reinforced resin rich interior surface all contribute to the successful service.

After less than 5 years in similar service: By comparison, pipe made by the centifugally cast method uses sand filled resin to create thickness and stiffness, and has an unreinforced resin rich inner surface. Thermal shock resulted in the resin on the interior surface cracking and flaking, exposing the underlying structural sand filled laminate, consequently the pipe failed.

Fibreglass Pipe Systems

Pipes & Sewer Capacities

ARMATEC Pipe Sizes

Standard pipe diameters available from ARMATEC are 100, 125, 150, 200, 225, 250, 300, 350, 400, 450, 500, 610, 760, 818, 910, 1070, 1200, 1480, and 1300 mm. Elbows and fittings are made to match these diameters. Special fittings are made to order: puddle flanges to embed in concrete, collars and spigots to match other pipes, etc.

Pipe Options

Standard options for buried pipe are stiffness factors of SN1250, SN2500, SN5000 and SN10000. For most applications SN5000 pipe is recommended (see page 13 for buried pipe design). Pressures to 10 bar for rising mains.

Jointing Options

'Butt and strap' joints are standard for secure leak-free joints that are stronger than the pipe itself. Flanged joints are ideal for transitioning between different materials. Sleeved flexible joints are also commonly used. Rubber ring joints can be used, but the rubber ring will probably have a shorter life than the fibreglass.

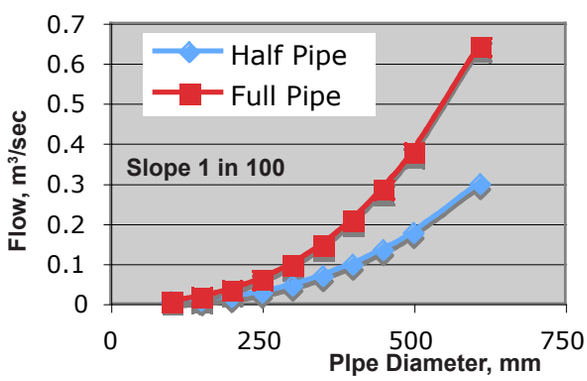
Suitable for Pipe Thrusting

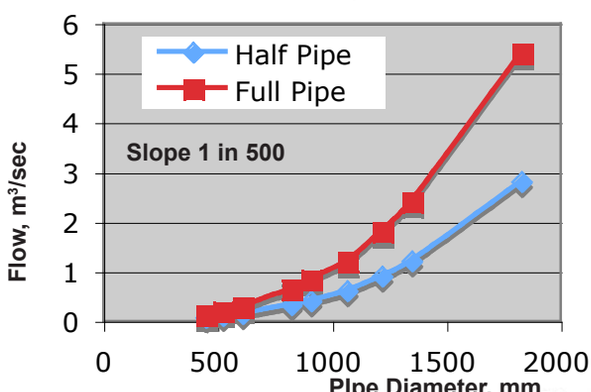
ARMATEC fibreglass pipe is contact moulded with high strength in the longitudinal direction, so can be installed by thrusting techniques after the hole is directionally drilled. A cone is provided at the leading end, and the pipe can be pulled, or thrust, or both. Quick cure jointing kits allow multiple thrusts per day; usually 4 to 6 metres is done at any one time. Contact ARMATEC to ensure the correct wall thickness of FRP pipe is used.

Capacities For Fibreglass Sewers

'Manning's equation' is used to calculate the flow through a gravity, by specialist drainage engineers once the line has been surveyed and the slope established. Charts at right can be used as a guide, and assume a small drop at the end of pipe, no applied hydraulic head and slopes as noted.

Fibreglass pressure pipe handling wastewater





Fibreglass Pipe Systems

Buried Pipe Wall Thickness

Typical pipe wall thickness is determined from standards. Each installation is specific. Structural layers of fibreglass take into account the buried depth, ground water table height, soil types, backfill material, and imposed loads, such as vehicles. This determines the minimum stiffness of the pipe required, and from there, the fibreglass pipe is designed to achieve this. Layers of chopped strand mat and coremat are combined to achieve the thickness needed for the required stiffness. A 2.5mm corrosion barrier thickness is included on the inside surface of the pipe.

ARMATEC pipe wall thicknesses (mm)
for different stiffness ratings:
Gravity drain and up to 100 kPa pressure applications

Nom Diam	SN1250	SN2500	SN5000	SN10000
150	5	5	5	5
200	5	5	5	5
250	5	5	5	7
300	5	5	6	8
350	5	6	7	9
400	5	7	8	11
450	6	7	9	12
500	7	8	10	13
610	8	10	13	16
760	10	12	16	20
910	12	15	19	24
1070	14	17	23	29
1200	16	20	26	33

Wall thicknesses shaded grey above incorporate Coremat.
All other wall thicknesses are combinations of CSM and WR as required.
Pipe thickness will vary for pressures over 100 kPa.
Stiffness of SN 5000 is usually necessary for traffic loadings.

Pipe wall thicknesses can be checked post manufacture using an ultrasonic tester (as shown at left). Manufacturing methods make the ends of the pipe several millimetres thicker than the body of the pipe. Measuring the pipe wall thickness at the ends of pipe lengths can therefore be misleading. Pipes with coremat as part of the laminate are unable to be tested with ultrasonic testers.

Fibreglass Pipe Systems

Buried Pipe Design

Specifying Pipe Stiffness

Fibreglass pipes are considered to be 'flexible' pipes. They are designed to deform or deflect diametrically within specified limits without structural damage. The degree of side support provided by the backfill used is a major determinant of the pipe stiffness required.

Parameters for Pipe Stiffness Specification:

- Type of backfill and compaction control used
- Native soil type
- Trench depth, width and wall angle
- Presence and height of ground water
- Pipeline operating pressures (+ve or -ve)
- Applied loads, e.g. traffic.

The site geotechnical engineer and consultant will generally be responsible for assessing these parameters, and will specify the pipe stiffness required. Note: the 'stiffness' of a pipe wall is proportional to the cube of the wall thickness, hence the wall thickness is the major parameter in achieving a high stiffness rating.

Low Stiffness Pipe Options

Installation must be carried out with great care when using low stiffness pipe such as SN 1250 or SN 2500. It is critical to carefully select backfill material, and ensure compaction is done to strict standards. The site geotechnical engineer and consultant must specify and approve pipe stiffness, excavations, backfill material, and supervise backfill installation. Even then, with low stiffness pipes, long term problems with pipe deflection and eventual cracking can occur. Generally, backfill requirements lessen as the pipe stiffness increases.

A Typical Project

In many drainage projects, there is ground water at ground level, traffic loads, buried depths of 1 to 3 metres, normal trench widths, and poor native soils. Projects are often done in difficult weather and to strict timetables. Compromises occur, so ARMATEC usually recommends:

- Pipe to be a minimum stiffness of SN 5000
- Normal trench widths to enable compaction along the sides of the pipe - wider at butt and strap joint locations
- Pipe bedding with 100mm minimum of compacted gravel/ scoria AP7/quarry fines
- Backfill with compacted gravel/scoria AP7/quarry fines, compacted in 300mm layers
- Ensure large or sharp objects are not in contact with FRP
- Backfill as above to at least 300mm above top of pipe
- Use native soil to backfill to ground level. Compact in 300mm layers

For deeper buried depths, or where the pipe has large applied loads, then custom design will be required.

Fibreglass Pipe Systems

Floor Drains

ARMATEC

"E-Trap" Floor Trap

- All fibreglass sump - all joints fully sealed
- Sump same material as pipes
- Stainless steel grate and water seal
- Easily cleaned
- Mates to standard monolithic floors
- Fewest cavities for bacteria
- No rubber ring joints to fail

Installation

Floor traps and connecting underground fibreglass pipe are preferably installed to grade before the concrete floors are poured at new sites. All fibreglass pipe joints underneath the slab are done by butt and strap, and will require no further maintenance. Pipes are then connected to fibreglass manholes located outside the building perimeter.

Jointing Fibreglass Pipe

Butt & Strap Joints

A butt and strap joint is simple to do. The resulting joint is stronger than the pipe itself. Consult ARMATEC for full instructions and training. Use only ARMATEC approved materials.

Pipe ends are cut square, sanded to clean material, butted together and joined with ARMABOND vinyl ester putty. Once cured, the joint is ready to strap. The surfaces are primed just prior to strapping.

Pre-cut layers of glass reinforcing are saturated with resin and consolidated to remove trapped air. This strap is then placed around the joint. Three to four layers of glass can be done at once.

The strap is consolidated with a ribbed roller to remove entrapped air and ensure a leak free joint. This strapping and consolidation process is repeated until the required thickness is reached.

Surfacing tissue is applied as the final layer to achieve a smooth spike free finish. Once cured the joint is resin coated.

VIDEO .... on butt and strap jointing ... http://www.youtube.com/watch?v=wLmi-w6xFH0

Fibreglass Manholes

Manhole Features

Stiffness
Stiffness to achieve buried design and vehicle loads is achieved by selecting the correct wall thickness as for pipe. Stiffening ribs can also be placed around the outside of the manhole.

Nozzles
Inlet and outlet nozzles are custom made to match the pipes ... butt fit with flexible joint and socket fit are common choices.

Flotation
An anti-flotation flange is typically fitted around the base of the manhole, and the weight of backfill counteracts flotation forces.

Anchoring Pipes
Inlet pipes can be anchored just outside the manhole to take up loads from thermal expansion. Otherwise these would stress the manhole to pipe joint.

Manhole Lids
Different styles are available to suit customer choices. Some styles allow for site trimming to final grade.

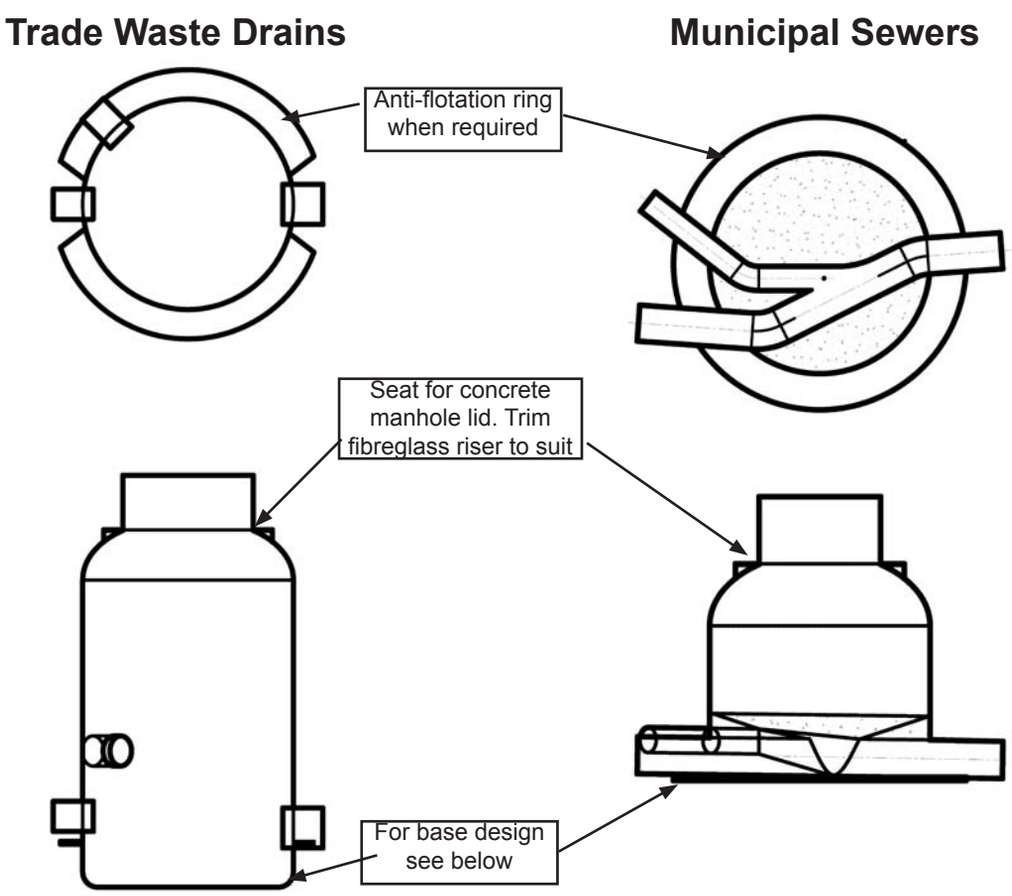
Ladders
Fibreglass or stainless steel ladders can be fitted internally to customer requirements. The fixing detail does not penetrate the fibreglass shell.

Fibreglass Manholes

Manhole Design

Fibreglass manholes in drainage systems are purpose built. The majority of work is done in factory, minimising site work and ensuring leak free construction.

Manhole Design



Trade Waste Base:
The base of a trade waste manhole has a 150 to 300 mm deep integral sump for the following reasons:

- Buffers fibreglass against thermal shock
- Buffers fibreglass against chemical shock
- Gives flow advantages
- Enables superior and more water-tight joints to be made on inlet and outlet pipes
- Extra height leeway for drainage contractor during installation
- Traps stones etc. protecting pipes

Municipal Sewer Base:
The base of a manhole for sewers has a flow through design so that solids cannot be trapped, i.e. self draining. The invert height and orientation of the main inlet and outlet are specified at design stage. This means the inlet, outlet, and haunching, are able to be done in our factory:

- Minimises work at site
- Leak free haunching and pipe joints
- Easy to clean smooth surfaces

Fibreglass Manholes

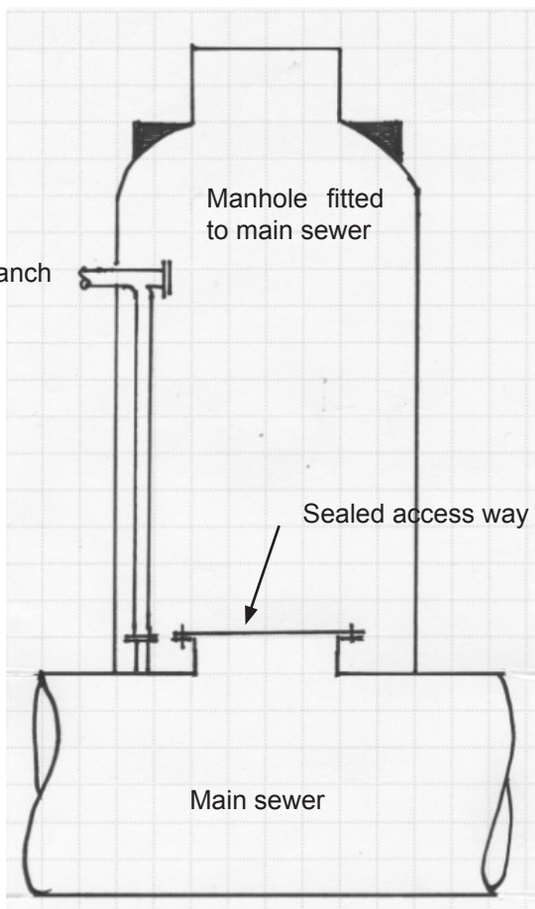
Sealed Sewers and H_2S

Sealed Sewers

Hydrogen sulphide gas is commonly found in sewers handling municipal wastewater. H_2S is both corrosive and highly toxic.

Sealed sewer systems are used to minimise the accumulation of H_2S, and the possibility of H_2S gases escaping to the environment. They are also used to streamline the flow and minimise the costs of site haunching.

In sealed sewers the main sewer line is totally sealed from the manhole (see sketch). The manhole can be placed over the main pipe at an elbow, or "wye" junction, or other branch.



H_2S Gas in Sewers

Personnel must take safety precautions before entering any sewer manhole. The H_2S concentrations can range from just a few ppm, to hundreds of ppm, and can kill quickly.

A number of people have been overcome by H_2S and died after entering sewer manholes. An unfortunate scenario is: a worker enters a manhole and collapses at the bottom; a second worker observes this and enters the manhole to assist, only to be overcome by the H_2S gases as well. Both will die if not assisted urgently.

H_2S causes throat and eye irritation, headaches, nausea, and fatigue. Symptoms become worse as the H_2S concentration increases. Loss of sense of smell occurs at concentrations over 150 ppm. Time to death is:

H_2S Conc: ppm	Time to Death
100 - 150	8 - 48 hours
150 - 200	4 - 8 hours
200 - 350	1 - 4 hours
350 - 450	38 minutes
450 - 700	2 - 38 minutes
Over 700	0 - 2 minutes

ARMATEC recommends that H_2S gas concentrations are measured and monitored during any manhole entry. In addition, ARMATEC practice is to blow fresh air into the manhole with a flexible duct, to provide a source of fresh air should a worker experience problems.

More on Sealed Sewers?

If you are interested in pursuing sealed sewers, please contact ARMATEC. We can prepare detailed drawings for your project.

Fibreglass Flumes

Fibreglass Flumes

Fibreglass is ideal for the complex shapes of flumes. The end product is one-piece and jointless. All flumes are made from accurately formed moulds, ensuring reproduction is achieved with a high level of accuracy. Flumes can be supplied with integral manholes.

Trapezoidal Flumes

Trapezoidal flumes offer accuracy at a wide flow range and are particularly suited for smaller flows under 100 m^3/hr. They have a flat floor with no hydraulic jump, therefore are particularly suited to flows with solids such as mixed sewers.

Parshall Flumes

Parshall flumes offer low head loss, which minimises the effect on the flow being monitored. They have a high degree of self cleaning capability and are able to withstand relatively high degrees of submergence without affecting the rate of flow. They are ideal for measuring a wide range of flow rates, especially larger flows over 100 m^3/hr.

Palmer Bowlus Flumes

Palmer Bowlus flumes are compact and portable and often used for retrofitting in an existing pipeline. They are specified according to the pipe size they are being fitted to.

Level Measurement Options

The liquid flowrate is determined by measuring the height of the standing wave formed in the flume. Two ways of measuring the height are:

- **Bubbler in Still Well:** Air is bubbled into the base of a still well connected to the throat of the flume. A pressure sensor on the air bubbler pump gives the measurement of the height of the standing wave. Stillwells can be used on clean water and non-crusting liquids.
- **Ultrasonically Level Transmitter:** Measures liquid level directly above the throat.

Parshall flumes for main city sewer flow monitoring

Parshall Flume installed in nine hour shutdown

Trapezoidal flumes for flow monitoring in small sewers. Easy to set up with flow sampling.

Fibreglass Pump Stations

Pump Station Design

Pump Stations

Wastewater and sewage pump stations are entirely fibreglass, with factory fitted inlet and outlet connections. They can come complete with outlet piping, pump rails, pumps, access ladder, electrics, etc. as required. Key benefits are:

- **No Corrosion for Long Life:** Corrosion is eliminated with all fibreglass construction, giving a design life of 75 years plus.
- **No Leaks:** Factory assembly seals all joints ensuring there is no infiltration or leaks of wastewater.
- **Fast Installation:** Units are complete when they arrive at site, light in weight and are easily handled - ideal for difficult or remote sites. Excavations need only be kept open for a short time, and confined space entry requirements are minimised.
- **Installed Cost Often Lower:** Costly site work is minimised, often due to the reduction in need for site subcontractors and their management. The total installed cost is often lower than a comparable concrete unit, according to many customers.
- **Easy Clean Smooth Surfaces:** Smooth internal fibreglass surfaces are easily and quickly cleaned with a medium pressure hose.

Pump Station Design

Pump station design starts with the pump to meet the required flow requirements, including peak wet and dry weather flows, but not exceeding the allowed number of pump starts per hour. The pump station vessel is then determined taking into account pipe invert levels and the required storage volume.

Detailed design is then finalised in conjunction with customer requirements. The top can include: a hinged lid, a cast manhole cover, or any other specific design. Piping material can be PVC, fibreglass, cast iron, or stainless steel as required. Anti-flotation collars, lifting lugs and hold down systems are standard.

Fibreglass pump stations are easy to transport and fast to install as fitout is completed off site.

Standard Sizes

Standard diameters available are 1070, 1200, 1480, 1830, 2000, 2400, 2800, 3050 and 3500 mm. Depths of the units are customised for your installation and typically range to 6000 mm. Pump stations are available with FLYGT TOPS Bases with FLYGT pumps for enhanced pump station performance.

Supply Details

Fibreglass pumping stations are manufactured by ARMATEC. Units incorporating FLYGT TOPS Bases are available from Xylem Water Solutions New Zealand ltd (formerly ITT Water & Wastewater) of Auckland: Phone 09-415-8687.

Fibreglass Pump Stations

Factory Manufacture & Fitout

Factory Manufacture & Assembly

Fibreglass pump stations are manufactured and assembled in ARMATEC's factory. Flygt TOPS bases are used to optimise hydraulics and minimise liquid retention. All parts are contact moulded for maximum chemical resistance. Anti-flotation rings and lifting lugs are standard. Joints are totally sealed outside and inside, eliminating infiltration and wastewater leaks to the environment.

Fibreglass pump stations parts are all manufactured and assembled in ARMATEC's factory.

Factory Fitout

Pump stations are fitted out in factory with pump guide rails and discharge pipes. Pump hold-down bolts are fitted with protrusions outside so they can be embedded in concrete on site. Fibreglass or stainless safety grilles and steel ladders can be installed to client specifications, all without penetrating the liquid tight envelope.

Flygt TOPS bases are used to optimise hydraulics and minimise liquid retention. All joints are butt and strap jointed outside and inside to create a liquid tight envelope that cannot leak.

Nozzles, ladders, pump guide rails and discharge pipes are all factory fitted.

Fibreglass Pump Stations

Pump Station Installation

ARMATEC

Light Weight

The light weight fibreglass pump stations can be handled at site by the excavator used to excavate the hole.

Excavation

Use safe excavation practices at all times. Once the pump station is in position, levelled and aligned correctly, the base of the pump station can be backfilled. A practice preferred by some contractors and customers is to pour concrete around the base. This locks the pump station in position, provides extra anti-flotation weight, and embeds the pump hold-down bolts. It is common to reach this stage within 6 hours of excavation beginning.

Connect Inlets

Inlets can then be connected and the pump station backfilled with gravel/scoria/ AP7 compacted in 300mm layers.

Ground Level Work

Valve chamber installation, outlet pipe connections, electrical wiring and instrumentation can be done at ground level. Finally, pumps are wired and lowered into place inside the pump station.

No Work Inside Pump Station

There is no need to enter the pump station once it has been installed. This minimises health and safety issues and costs, including safety barriers, harnesses, lifting equipment, and having trained supervisors at site.

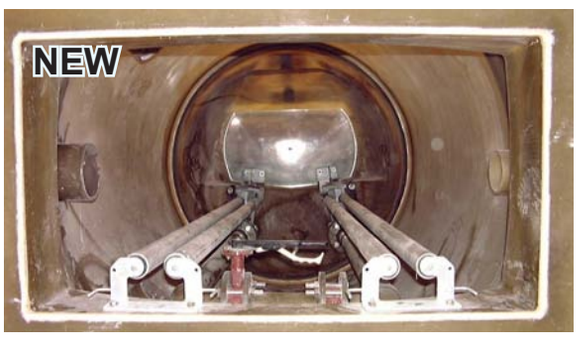
Completed Installation

Final contouring and landscaping are then completed to site requirements.

Fibreglass Pump Stations

Pump Station Operation

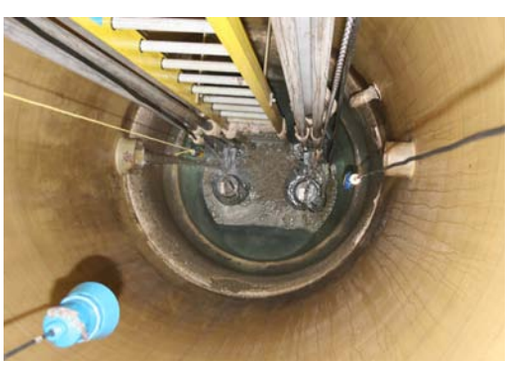
11 Years Service: The fibreglass pump station below, is in excellent condition after 11 years service in corrosive dairy CIP and milk product wastes. Valves handles, cast iron frames, and other metal parts have deteriorated due to the corrosive nature of the wastewater and environment.



Ease of Cleaning: The smooth interior surface of fibreglass pump stations are easily cleaned with a standard pressure hose. The pump station pictured below took less than 10 minutes to clean.

Earthquakes: The 2010 and 2011 earthquakes in Christchurch caused extensive damage to the city's wastewater network. Fibreglass pump stations fared well. The vertical acceleration component of the earthquakes cracked concrete surrounds (below left) at a Lyttleton pump station, and sheared outlet pipes on two Christchurch stations. No liquid envelopes were damaged. Outlet nozzles were strengthened (below right), and more flexible HDPE discharge piping to the valve chamber was installed.

Cracks in concrete.



No damage to liquid envelopes

Strengthened outlet pipes

Horizontal Surge Tanks

Horizontal Surge Tanks

These are used to provide additional wastewater storage but at the same time minimising construction work. They can be installed in conjunction with a pump station, or can have a pumping chamber incorporated in them. Constructed in fibreglass, they provide the same benefits as fibreglass pump stations:

- **No Corrosion:** Corrosion resistant fibreglass construction for long, low maintenance life.
- **Light in Weight:** Easy to handle and install with standard equipment.
- **No Leaks:** The all fibreglass construction and factory assembly ensures there can be no infiltration or leaks of wastewater.

Flexible Design

Detailed design is finalised in conjunction with customer requirements. Typical diameters are 1800mm through to 3500mm, to lengths required. Anti-flotation fittings are standard.

Supply Details

Fibreglass horizontal surge tanks are manufactured by ARMATEC, and are available from ARMATEC and Xylem Water Solutions New Zealand Ltd (formerly ITT Water & Wastewater) of Auckland: Phone 09-415-8687.

Horizontal surge tank under construction. Pump out chamber is fitted to one end of surge tank.

Light weight horizontal surge tank is easy to transport and install.

Fibreglass Valve Chambers

Fibreglass Valve Chambers

These are designed to work in conjunction with fibreglass pump stations to provide the same benefits:

- **No Corrosion:** Corrosion resistant fibreglass construction for long, low maintenance life.
- **Fast Installation:** Units are complete when they arrive at site, with valves and hatches already installed.
- **Light in Weight:** Easy to handle and install with standard equipment.
- **No Leaks:** The all fibreglass construction and factory assembly ensures there can be no infiltration or leaks of wastewater.

Fibreglass valve chambers leave ARMATEC's factory fully assembled and ready to install at site.

Flexible Design

Detailed design is finalised in conjunction with customer requirements. The top can include: a hinged lid, a cast manhole cover, or any other specific design. Piping material can be PVC, fibreglass, cast iron, or stainless steel as required. Anti-flotation collar is standard. Floor is sloped to corner sump/drain.

Fibreglass valve chamber (rear) to match fibreglass pump station.

Supply Details

Fibreglass valve chambers are manufactured by ARMATEC, and are available from ARMATEC and Xylem Water Solutions New Zealand Ltd (formerly ITT Water & Wastewater) of Auckland: Ph 09-415-8687.

Rectangular valve chamber options available. Mag flow meter can be included in chamber as required (right).

Fibreglass Carrier Pipe

Fibreglass Carrier Pipes

Fibreglass 'Carrier Pipes' can be fitted around inlet and outlet piping from pump stations and valve chambers. They provide room for the pipe to move horizontally and vertically during ground consolidation, or in an extreme event like an earthquake.

Carrier Pipe Design

The 'Carrier Pipe' is supplied in short lengths in two halves that fit together at site. Soft foam supports are used to position the internal pipe. A 'Carrier Pipe Starter' is fitted to the pump station or valve chamber, and the 'Carrier Pipe' is fitted to this. The 'Starters' are usually factory fitted, or can be site fitted later.

Pump Station to Valve Chamber

Pump stations and valve chambers are often located a short distance apart. If there is ground consolidation or movement of the vessels, the connecting pipes can become stressed and fracture at the ends. This occurred at sites during the Christchurch earthquakes of 2010 and 2011. A possible solution is to install the connecting pipes in 'Carrier Pipes' that give room for the connecting pipes to move unrestricted by the backfill.

Outlets and Inlet Pipes

A short length (e.g. 1.5 metres) of 'Carrier Pipe' can be installed on the outlet of the pump station, and both the inlet and outlet of the valve chamber. This reduces the chance of the pipe fracturing during movement.

Protection During Excavation

HDPE pipe can easily be damaged by excavation equipment. 'Carrier Pipe' protects the pipe during excavation for maintenance.

Supply Details

Fibreglass 'Carrier Pipes' are available from ARMATEC, and can be site fitted by contractors.

HDPE pipe before 'Carrier Pipes' installed.

'Carrier Pipe Starter' fitted to pump station end.

First 'Carrier Pipe' installed.

Both 'Carrier Pipes' installed. HDPE pipe is now protected.It has room to move reducing chances of fracture due to ground movement.

Odour Control Systems

Carbon Bed Adsorbers

Carbon bed adsorbers are ideal for larger pump stations that are required to be under a negative pressure to contain the odours. They are most cost effective for situations when H_2S concentrations are low, and when zero odours are allowable in the discharge. H_2S odours and volatile gases are removed from air streams by adsorption onto a bed of activated carbon. They are simple to operate, and require minimal maintenance.

- Upflow design is standard.
- Corrosion resistant fibreglass construction, results in low maintenance and long life.
- Fan separate, for ease of servicing.
- No fan ... see 'Green Dome™ Odour Filters'.
- Footprint 10% of a soil bed filter.

Carbon bed adsorber on municipal pump station. System includes pre-filter, heater for humidity control, fan in acoustic enclosure, and carbon bed adsorber.

Biological Scrubbing

Biological scrubbers treat polluted air biologically. They are ideal for higher H_2S concentrations. Footprint is small, and only minimal chemicals are needed. The waste air is contacted with a scrubbing solution in a vessel packed with an inorganic support material. On the surface of the packing, a biofilm of pollutant degrading microorganisms forms, which aerobically degrade the absorbed pollutants. A carbon bed adsorber is required as a final polishing stage when a totally odour free discharge is required.

Biological scrubber for H_2S up to 300 ppm

Soil Bed Filters

Soil bed filters treat the odour biologically in an in-ground filter. ARMATEC provides corrosion resistant fibreglass ducting and fans to move the air. ARMATEC can also provide the design for the soil bed filter if required. Soil bed filters have a footprint typically 10 times as large as carbon bed adsorbers and biological scrubbers.

LCCs - Life Cycle Costs

LCC analyses are available for comparing carbon bed adsorbers, biological scrubbers and soil bed filters. Please contact ARMATEC.

More Information

Bulletins on ARMATEC carbon bed adsorbers and biological scrubbers are available on our web site.

Green Dome™ Odour Filters

Green Dome™ Odour Filters

Purpose designed carbon bed adsorbers for removing odours and volatile gases from air vented from a pump station, i.e. as it "breathes". No fan is needed. Green Dome™ Odour Filters are ideal for smaller pump stations when zero odours are required in the discharge. They require no operator input or maintenance, other than changing the carbon when spent. They are located adjacent to the pump station or air release valve, but out of the way of service crews.

Green Dome™ Odour Filter on pump station vent. No fan. No power. No moving parts.

Features

- Proven carbon adsorption technology
- Low profile for minimum visual impact
- Inlet ducting below ground out of sight
- No fan, heater, or moving parts to service
- Zero power consumption
- Compact light weight design
- Robust corrosion resistant fibreglass construction
- Carbon life up to 5 years, depending on load
- Carbon easily changed
- Dipstick indicates rate of carbon usage.

Green Dome™ Odour Filter on pump station.

Size Range Available

Choose the model to suit the maximum possible filling rate in the pump station, often 50% of the pumping rate for the pump station. Consult ARMATEC for confirmation.

Model Number	Maximum Airflow l/sec	Minimum Duct Size mm	Standard Carbon Load kg
GDOF 12	3	50	11
GDOF 16	6	50	19
GDOF 20	9	75	30
GDOF 24	13	75	44
GDOF 30	29	100	68
GDOF 36	43	100	98
GDOF 42	68	150	158
GDOF 48	91	150	199
GDOF 60	138	200	301
GDOF 72	211	200	526

Green Dome™ Odour Filter installed on vent from air release valve

Vortex Dropper Formers

Vortex Droppers

Vortex droppers lead wastewater into a drop pipe to a pump station or large manhole. The flow is turned and swirled as it enters the central drop pipe. Vortex droppers are used to avoid wastewater impinging on the side of the pipe or manhole in an uncontrolled manner. This results in less:

- Erosion
- Turbulence
- Entrained air to affect pump performance
- H_2S and other gases evolved.

ARMATEC manufactures vortex dropper formers to achieve smooth curved surfaces for the least turbulence. Reinforced concrete is poured behind the fibreglass former to achieve structural integrity necessary for the project. Stiffeners are integrated into the fibreglass, to provide strength during backfilling of concrete, and to physically lock the fibreglass to the concrete. Concrete pours are done in several lifts to avoid collapsing the fibreglass former.

The fibreglass is surfaced with a special ARMATEC abrasion resistant layer to provide additional resistance to wear and erosion. This layer is incorporated during fibreglass manufacture, therefore is integral with the unit.

At site special attention is paid to the ends of the vortex dropper former to ensure wastewater cannot infiltrate behind the fibreglass.

Vortex former lifted into place

Setting up for concrete to tie to vortex former

Drop pipe installed before vortex former fitted.

Vortex former and dropper being manufactured

Fibreglass Tanks

Fibreglass Tanks

High quality contact moulded fibreglass tanks are ideal for storing and handling chemicals and wastewater. Fibreglass tanks are chemically resistant inside and out.

Options Available

Fibreglass tanks can be built to any design required. The most economic tank is a vertical cylindrical vessel with a flat bottom and domed roof. Horizontal tanks are well suited for buried applications for wastewater. Options include: raised bases, sloping bases, conical bases, nozzles, access ways, access platforms, access ladders, tank support legs, ring mounted supports, insulation, exterior colouring, level indication, clean out sumps, baffles, agitator supports, etc.

Tank Integral with Pump Station

Pump stations can be configured with additional wastewater storage volume, and in some cases this can eliminate extra tanks.

HSNO & ERMA Certification

Tanks containing hazardous chemicals are required by the HSNO Act 1996 to hold a warrant of fitness to be renewed annually with EPA. To assist you achieve this requirement:

- ARMATEC has a 'Stationary Container Fabricator Test Certificate' certifying ARMATEC to manufacture fibrelass tanks up to 60,000 litres. The EPA number for ARMATEC's test certificate is FAB 0004.
- A 'Stationary Container Design Verification Certificate' from an EPA registered test certifier is issued to you for each tank, together with ARMATEC's 'Producer Statement'.

More Information

Check out the 'Free Information' section of ARMATEC's website for more on properties of fibreglass, handling of fibreglass tanks, etc.

Fibreglass tank for CIP wastewater

Pump station with extra storage capacity

Chemical tanks for wastewater treatment plant, storing sodium hydroxide, alum and sulphuric acid

Fibreglass tank at pulp and paper mill, receiving filtrate from paper making process.

Coatings & Linings

VInyl Ester & Epoxy Coatings

For Concrete & Steel

ARMATEC's reinforced coating systems for concrete and steel are based on corrosion resistant vinyl ester and epoxy resins. They range in thickness from 0.5 mm to 5 mm. Reinforcements include glass fibres and flakes. The coatings integrate well with ARMATEC's range of fibreglass products. Surface finishes vary from smooth, for ease of cleaning, to non-slip, and abrasion resistant.

Vinyl Esters Standard

Vinyl ester resin based coatings are popular because of their comprehensive chemical resistance. They are easy to apply. A totally dry substrate is required.

Moisture Tolerant Epoxies

Our ARMALINE® range of coatings features moisture tolerant epoxies that will bond to a damp substrate and cure underwater. They are ideal for shutdown work, or where it is difficult to achieve a totally dry substrate; as in manholes and wastewater sumps.

Barrier Technology for Long Life

Ultra low permeability is achieved with the use of special blends of flakes and fillers. This forms an armour like barrier against moisture and chemicals, giving the best protection possible for the substrate. The result is long life, less frequent replacement; thus a low life cycle cost.

Surface Preparation Needed

• **Concrete**: Provide a clean, dry, porous surface, free from lumps and protrusions. High pressure water blasting, abrasive blasting, scabbling and acid etching are methods that can be employed.
• **Steel**: Abrasive blast to achieve a near white finish and a minimum profile of 75 microns, with 100 microns being optimum.

Uses

- Sumps and manholes, eg from H_2S attack
- Chemical bunds, eg 98% sulphuric acid etc
- Factory floors
- Tanker unloading areas
- Wastewater storage tanks and pits
- Wastewater drains
- Concrete pump stations

Coatings & Linings

Wastewater Sump Coatings

Photo 1: Vinyl ester coated CIP chemical waste neutralisation tank at brewery. In 10 years operation, the only maintenance has been repairing a hole made by a runaway mixer blade. **Photo 2:** Wastewater structure coated in two day repair with moisture tolerant epoxy. **Photo 3:** Concrete wastewater sump at dairy factory coated with trowel on vinyl ester. **Photo 4:** Concrete sump at dairy plant coated with moisture tolerant epoxy. **Photo 5:** Municipal pump station coated with moisture tolerant epoxy coating to resist wastewater and H_2S attack. **Photo 6:** Wastewater sump repaired and coated with moisture tolerant trowel on epoxy coating.

Coatings & Linings

Fibreglass Liners

Fibreglass Liners

FRP Liners are used to reinstate deteriorated walls of concrete manholes and pump stations. FRP Liners are factory made. At site they are inserted, the bottom and inlet pipes sealed, and then the cavity between the liner and concrete is grouted. The underside of the top is coated with Armaline™ moisture tolerant epoxy coating.

Manholes

Complex contours in the base of manholes are coated with Armaline™ moisture tolerant epoxy coatings. The FRP Liner is then sealed to this, inlets are made off, and the liner grouted.

Pump Stations

A Flygt TOPS Base is inserted into the base of the pump station and grouted in place. Then the FRP Liner is landed on the top edge of the base and sealed to it, inlets are made off, and the liner grouted.

Benefits of FRP Liner

- **Restores strength** - to deteriorated concrete manholes and pump stations.
- **Corrosion resistant** - to H_2S and wastewater.
- **Easy clean surface** - smooth internal finish.
- **No infiltration or leaks** - the grouted liner seals all current leaks.
- **Indefinite life** - 50 years plus.

Fast Installation

Minimal excavation is required compared with totally replacing the manhole or pump station. Installation can be done in a few days, minimising disruption and costs.

Detailed Design

Contact ARMATEC engineers for the design of the FRP Liner. It is essential that the wall thickness and stiffness are sufficient to handle the loads during grouting.

Factory made FRP Liner ready to install in manhole. External ribs provide stiffness to maintain shape.

Lowering FRP Liner into place. The top of the manhole has been removed, and the underside is coated.

Just four days and a few square metres of excavation was needed to install a FRP Liner in this manhole. If the manhole had been replaced, extensive disruption including road and bar closure would have occurred.

Quality Assurance

ISO 9001 Certified

All products are designed and manufactured to applicable international standards. To ensure the highest level of quality assurance is provided, ARMATEC Environmental Ltd maintains a Quality Assurance System covering both design and manufacture. ARMATEC's Quality Management System is verified as compliant with ISO 9001 by Bureau Veritas Certification.

Industry Standards

- AS 2634: Chemical Plant Equipment Made from Glass-Fibre Reinforced Plastics (GRP) Based on Thermosetting Resins. In process of being superceded by EN 13121. Easy to use standard that continues to be widely specified and used.
- BS 4994: Design and Construction of Vessels and Tanks in Reinforced Plastics. In process of being superceded by EN 13121.
- EN 13121: GRP Tanks and Vessels for Use Above Ground - new European standard
- ASTM RTP1: Reinforced Thermoset Plastic Corrosion Resistant Equipment - USA standard includes pressure vessels
- AS/NZS 3571: Glass Filament Reinforced Thermosetting Plastics (GRP) Pipes - Polyester Bases - Water Supply, Sewerage and Drainage Applications - FRP pipe for public utilities
- AS/NZS 2566 - for buried flexible pipelines
- AS/NZS 1170 - for seismic and wind loads
- ANSI/AWWA M45 - Fibreglass Pipe Design Manual, 2nd Edition
- ANSI/AWWA C950-01 - AWWA Standard for Fibreglass Pressure Pipe

Quality Control

- ITPs (Inspection & Test Plans) as required
- Post fabrication thickness checks
- Post cure Barcol hardness checks
- On site logs for coatings and linings
- Coatings and linings - spark testing and thickness checks
- ISO 9001 - materials traceability and design audits
- Standardised laminate testing (see table below)

Barcol Hardness testing to check laminate is cured

ARMATEC Quality Control Example:

AS 2634 specifies that, in order to use the minimum thicknesses stated in the standard, a manufacturer must produce a FRP laminate that has certain minimum properties. The table at right lists values of the ultimate strength of various thickness ARMATEC FRP laminates and compares them to the minimums, as per AS 2634. ARMATEC FRP laminates exceed the minimums in all cases.

ARMATEC Standard Laminate Testing

Thickness	AS 2634 Minimums	ARMATEC Laminates*	Exceeds Minimums
3.1 mm	57 MPa	103 MPa	+ 80%
4.6 mm	68 MPa	127 MPa	+ 87%
5.9 mm	77 MPa	107 MPa	+ 39%
9.7 mm	100 MPa	124 MPa	+ 24%
10.3 mm	100 MPa	167 MPa	+ 67%

* By Materials & Testing Laboratories Ltd to AS 1145

Specifying Fibreglass

Suggested Specification for Fibreglass

All fibreglass manholes, sumps, pipes, fittings, flumes, and pumping stations are to be designed and manufactured by ARMATEC Environmental Ltd, to handle traffic, hydraulic and water table loads, as specified. Design and manufacture is to meet international standards such as AWWA M45, AWWA C950-01, AS/NZS 3571 and AS/NZS 2566. All buried items must achieve a minimum stiffness of SN 5000 *(or as determined by the site geotechnical engineer)*. Fibreglass manufacture process is to be the contact moulded method for maximum chemical resistance/. Fibreglass products must meet the requirements of international standards, including AS 2634 'Chemical Plant Equipment Made from Glass-Fibre Reinforced Plastics (GRP) Based on Thermosetting Resins'. Premium grade corrosion resistant isophthalic resins (sewers) or vinyl ester resins (trade wastes) are to be used. A 2.5mm corrosion barrier is to be included on all equipment. All site joints are to be butt and strap, and carried out by individuals suitably experienced and trained by ARMATEC.

Corrosion Barrier Is Essential

Standards AS2634, BS 4994, EN 13121, and ASTM RTP1 all require a 2.5mm corrosion barrier on all surfaces exposed to the chemical environment. It is included as standard in all products designed and manufactured by ARMATEC. This corrosion barrier protects the structural layers of the fibreglass from the chemicals, ensuring long term strength of the laminate. The internal surface of the corrosion barrier is a 0.5mm resin rich layer reinforced with a fine tissue for strength. The final 2mm is reinforced with contact moulded non-continuous glass. When specifying and purchasing fibreglass products for use in corrosive environments such as drainage projects, always ensure that a 'Corrosion Barrier' is included.

Fibreglass is Light Weight
The light weight of fibreglass makes it is to handle, transport and install. Use nylon or fabric slings, cradles, and avoid point loads at all times.

Hot Corrosive Drains
Fibreglass is resistant to aggressive chemicals making it ideal for corrosive mixtures commonly found in drainage systems.

Handling Fibreglass

Fibreglass is strong, lighter, and more flexible than steel. It is however, subject to cracking and chipping if incorrect handling and transporting methods are not adhered to. Never under any circumstances apply a point load to fibreglass, as this will cause localised damage.

1. Good Rigging Methods
Use OSH guidelines and good rigging methods at all times. Attach a rope to guide the lift. Ensure the appropriate safety equipment is used. Keep people clear.

2. Lifting Vessels & Pipes
Where lifting lugs are provided, they should always be used. DO NOT LIFT OFF NOZZLES. For vessels and pipes, place a sling around the vessel or pipe, then choke it through the eye of the sling. This distributes the load evenly. Ensure the sling cannot slip off during the lift. Do not place a hook in the ends of a pipe.

3. Use Nylon or Fabric Slings
Use only approved nylon or fabric slings for lifting or moving fibreglass equipment. DO NOT USE CHAINS OR CABLES UNDER ANY CIRCUMSTANCES.

4. Laydown: Avoid Point Loads
Ensure there are no sharp point loads under any fibreglass equipment when loading onto a truck or onto the ground. Purpose built cradles are the best method for handling large fibreglass items (available from ARMATEC and returned after use). Ensure no point loads are placed on any nozzles or pipes. Sharp objects such as stones can cause point loads that result in damage. Ensure fibreglass equipment is restrained, so that it cannot roll away or be moved by wind. Store out of the way of working machinery and vehicles.

5. Moving Around at a Site
Fibreglass equipment is light in weight and can be manhandled on site, by rolling or sliding if lifting equipment is not available. Sharp objects such as stones must be avoided by using sledges or planks. When righting a vessel from the horizontal position, care should be taken that the bottom corner is cushioned with soft material to prevent damage. If entering a vessel or pipe, wear soft soled footwear and provide protective coverings to save the surface from damage due to the dropping of equipment or tools.

6. If Damage Occurs
Advise ARMATEC immediately. Damage is usually limited to a small spot and can be easily repaired before final installation of the equipment.

7. Fibreglass Resins
Materials for site joints are hazardous and flammable. They must be stored in a secure and dry location, away from sources of ignition. Store in the original containers from ARMATEC.

ARMATEC Capability





ARMATEC supplies equipment and specialist products to help industry and local authorities reduce emissions to the environment. We have established a reputation for high quality corrosion resistant products for tough environments. This includes air pollution control products, such as: wet scrubbers; fibreglass fans for corrosive air streams; coatings to resist aggressive chemicals; fibreglass fabrications including tanks, pipes, manholes, covers etc; and wastewater treatment products. ARMATEC undertakes projects of all sizes ranging up to turnkey projects worth in excess of a million dollars.

Why ARMATEC?

12 Reasons to choose ARMATEC as your supplier

Highest Chemical Resistance
All products are 75% resin as they are made and assembled using the contact moulded method. This is the highest resin percentage of all manufacturing methods and ensures our products have the best chemical resistance possible, as it is the resin that gives fibreglass products its chemical resistance.

World Class Technology
With more than 25 years experience in industrial fibreglass work, plus close links and licences to world technology leaders, we can provide the most up to date and applicable technology for your project.

Documented Case Histories
Successful case histories of installations in New Zealand and around the world allows us to stand behind our guarantees. Proof our products perform for years and years.

Highly Experienced Tradesmen
Our tradesmen have many years of experience in industrial fibreglass, in both large and small industrial sites. Many customers ask for our senior tradesmen by name. We have been servicing industrial sites in NZ longer than some site staff have been employed, therefore we know your equipment and site.

Specialists at Site Work
When a shutdown occurs, or an urgent job takes priority, we know what this means and we will work to your timetable and prioritise to meet your deadline. We are proud to say that we have never delayed a startup.

Certified Tank Manufacturer
ARMATEC is certified by ERMA under the HSNO Act to manufacture fibreglass tanks.

Quality Assurance
Manufacturing processes are implemented to strict Quality Control procedures, and management systems are certified for compliance against ISO 9001 (2008) by BVQI. Project management is co-ordinated to comply with customer QHSE requirements. Pre-job evaluation is done to assist with minimisation of risk and improved site management. ARMATEC management promotes high standards of QHSE.

Guaranteed Performance
Products are guaranteed to perform in the service conditions stated. If they fail we will replace them.

Fully Insured
For your peace of mind we have full insurance, including $10 million public liability insurance.

Responsive to Customer Needs
Projects are never straight forward. Changes in design and methodology as the project develops means variations. We understand this, and will help you to optimise the project by being responsive to your needs.

Industry Leaders
ARMATEC personnel are at the forefront of the NZ Composites Industry and have an ongoing leadership involvement in the Composites Association of NZ (Inc.).

Chemical Engineers
Your chemicals and processes are not a mystery to us. Our experienced chemical engineers understand what you are doing, and hence can make the best product recommendations to you.

Frequently Asked Questions

Q: How difficult is FRP for a contractor with no FRP experience?
A: Very easy. Typical contractor comments are .. "After the first one we loved them." Nothing really changes other than the project goes much faster at site. ARMATEC offers training for contractors; either at site or in ARMATEC's factory.

Q: How does it compare cost wise with concrete options?
A: The initial component price is higher, but the total installed cost can be lower, if ALL costs are factored in. One customer told us ... "The total completed cost of the fibreglass pump station was about 60% of what it would have been if we had done it in all concrete." This is of course site specific, but comparing like with like, and allowing for fibreglass's corrosion free long life, fibreglass gives you LOWER LIFE CYCLE COST.

Q: How about infiltration ?
A: The butt and strapping of every joint in manholes, pipes and pump stations, ensures leak free joints. Especially as many of the joints are done in the factory. A customer commented ... "This is why I want fibreglass. The joints can't leak. Infiltration can't happen."

Q: What size crane do I need at site?
A: You don't! Generally the same digger used for excavating can be used for lifting and placing, saving you time and cost. For difficult access sites this is particularly important, with substantial savings possible.

Q: What cleaning schedule should I adopt with FRP pump stations?
A: The smooth internal surfaces of fibreglass greatly reduces fat and solids buildup. The use of FLYGT TOP bases on pumping stations greatly reduces the amount of solids that collect in the base, meaning less cleaning and less maintenance. Comments made by one customer were ... "With fibreglass, we have been able to double the time between cleaning cycles of the pump stations." Others find that cleaning is much faster, and a cleaner surface is achieved.

Q: How long will fibreglass last?
A: Indefinitely. The design life is 50 years. Fibreglass has been around in this sort of application for around 50 years. Some of the installations dug up after 30 years are as good as the day they were first installed. Early installations done by ARMATEC in the Dairy Industry in the late 1980's are still in operation today and are as good as the day they were installed.

Q: Are fibreglass dust and resins dangerous?
A: All dusts are harmful to lungs. Appropriate dust protective masks and safety glasses should be worn when cutting and grinding fibreglass. Resins and clean up solvents are flammable, so must be kept away from naked flames. The OSH TWA (time weighted average) for styrene is 50ppm, and this concentration will never be reached in a properly ventilated space. If working inside a vessel, provide ventilation and wear a carbon based protective mask. NEVER take solvents into a confined space under any circumstances.

Published Paper:

The following is the abstract and introduction from a paper on fibreglass for use in trade waste sewers. The full paper discusses the history of fibreglass useage in New Zealand industry, applications, engineering aspects, chemical resistance, design factors, standards and quality assurance.

Fibreglass for Corrosion Resistant Trade Waste Sewers

Author: K.M. Holyoake. Managing Director, Armatec Environmental Ltd

Presented at NZWWA Trade Waste Conference, Auckland, August 2008

ABSTRACT:

Fibreglass is widely used in trade waste sewers due to its corrosion resistance both inside and outside, its light weight and versatility in fabrication. Applications include pipelines, manholes, sumps, pumping stations, flumes, and storage tanks. Fibreglass was initially used in acid chlorine sewers in the pulp and paper industry, but use has now spread to most industry including those using acids such as food processing plants for CIP (clean in place) chemical waste streams. For applications to be successful, the fibreglass needs to be designed correctly, the right resin choice needs to be made, and appropriate international standards need to be followed. This paper looks at these issues to give users a better understanding so that fibreglass can be used with confidence and success.

1. INTRODUCTION

Worldwide, fibreglass has been used in the pulp and paper industry for more than 4 decades, especially for acidic chlorine solutions including waste streams. This industry almost single-handedly drove the development of resins with high chemical resistance such as bisphenol polyester resins, halogenated polyester resins, and more recently vinyl ester resins. Like mills in the rest of the world, the two New Zealand pulp and paper mills have used these resins since the late 1970s and they continue to use them today.

The New Zealand dairy industry, after years of difficulties with corroding chemical sewers, first tried fibreglass in 1988 at the Kauri site in Northland. Manholes and pipes made for this project are still in use today and are in excellent condition. The New Zealand Dairy Research Institute installed a test rig at the Hawera site in Taranaki between 1992 and 1994. This test rig was exposed to actual CIP wastewater chemicals, ie the many different concentrations and temperatures that dairy plants produce. The test report stated that the vinyl ester FRP pipe samples "appear to be completely unaffected" and "appeared to have excellent resistance to the dairy wastewater". The report also stated "many of the ceramic pipes that were readily available in New Zealand had softened significantly since installation".

Continues ...

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URL address is: http://www.armatec.co.nz/Free-Information

Published Paper:

The following is an abstract from a paper on fibreglass packaged pump stations. The full paper discusses engineering aspects and benefits of fibreglass, and reviews case histories of a number of pump stations including ones that went through the Christchurch earthquakes of 2010 and 2011.

FIBREGLASS PUMP STATIONS: 10 YEARS EXPERIENCE IN NEW ZEALAND

Holyoake, K.M.; ARMATEC Environmental Ltd, and Guthrie, B.C; ITT Water & Wastewater NZ Ltd

ABSTRACT

Pump stations constructed in fibreglass have been successfully used for handling municipal and industrial wastewater for ten years in New Zealand. This paper reviews these experiences, and the engineering details that have contributed to this success.

The engineering properties of fibreglass are well known. Fibreglass is a flexible material with strain to failure of 2%. Yield strength and ultimate strength are the same. Design safety factors of three to ten are used, so that the design point is well away from the yield point. This design gives good resistance to sudden shock loads, such as earthquakes.

The service life of a fibreglass pump station is dependent on the chemical resistance of the resin. Isophthalic polyesters are used in municipal pump stations, and vinyl ester resins are used in industrial chemical pump stations where chemical concentrations and temperatures are higher. Both resins are resistant to hydrogen sulphide gas. The 50 to 100 year design life required in municipal wastewater networks is achieved by fibreglass. When properly engineered and constructed, fibreglass has an indefinite life in these applications.

Fibreglass pump stations achieve engineering benefits because they are fabricated, assembled, and fitted out in a factory so that on-site work is minimised. Factory 'butt and strap joints' are easily done and quality assured, and this eliminates future leaks and infiltration. Bases are moulded with sloping sides to optimize pumping and minimize solids settling. Pump hold-down bolts are factory fitted; with anchoring plates located outside the pump station. These are captured in concrete on installation to ensure pump security. The weight of backfill on a factory fitted anti-flotation ring provides the required anti-flotation force. The lightweight of fibreglass reduces transport and installation costs.

Case histories are presented of a variety of installations, including municipal stations and one in a dairy factory handling CIP wastes. Four of the pump stations reviewed endured the Christchurch earthquakes of 2010/11.

LCC (life cycle cost) analysis shows that fibreglass pump stations have the lowest cost over a 100-year life. Whilst costing more at the time of initial purchase, the installed cost can be similar or less than conventional concrete pump stations. Further during the 100 year period, the fibreglass pump station needs minimal maintenance whereas others would need maintenance and replacing, or at the very least re-coating, on a regular basis.

KEYWORDS
Fibreglass, pump stations, wastewater.

Continues ...

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ARMATEC Videos

For information and training

The following short videos have been uploaded to 'YouTube' and are available to view. They can be used for planning, information, or training purposes. Insert the relevant 'URL' address in your browser, and this will link directly to the video. Otherwise in 'YouTube', search for 'ARMATEC Environmental'.

Title: ARMATEC Fibreglass Pipe Jointing

YouTube URL: http://www.youtube.com/watch?v=wLmi-w6xFH0

Butt and strap jointing of fibreglass pipe.

Title: ARMATEC Install Fibreglass Pump Station

YouTube URL: http://www.youtube.com/watch?v=A8Ji1AdDCcw

Installing an all fibreglass pump station.

Title: ARMATEC Fibreglass at WWTP

YouTube URL: http://www.youtube.com/watch?v=5C72-hNOpJc

ARMATEC fibreglass products used at Mangere wastewater treatment plant in Auckland, New Zealand: fans, ducts, scrubbers, dampers, etc.

Title: ARMATEC Algae & Phosphorus Removal Waihi

YouTube URL: http://www.youtube.com/watch?v=Zi_LCxY4tcs

Tertiary wastewater treatment plant removing algae and phosphorus from Waihi oxidation pond effluent.

Title: ARMATEC Manhole Installation

YouTube URL: http://www.youtube.com/watch?v=wwLuIN13Ztg

Installation of a fibreglass manhole complete with integral flume.

ARMATEC Website

Get the most out of our website

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Information on ARMATEC

Engineering information available to download

Projects we have done

Contact details

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