

**POLYETHYLENE SUBMARINE WATER PIPE WITH STEEL ARMOR**

# AQUALEX





# Structural Design

“AQUALEX”, a polyethylene pipe with steel armor manufactured by Furukawa Electric is a submarine pipe for liquid supply applications, exploiting various advantages of polyethylene pipes, including “flexibility”, “anti-seismic properties” and “eco-friendliness”. Further, with increased “pressure resistance”, enabled by the internal pressure reinforcement layer, and superb “weather resistance”, “corrosion resistance” and “damage resistance” in addition to “mechanical strength” based on the steel armor and anticorrosion layer, the product serves as an ideal solution for supplying / distribution liquid in the submarine environment. Because the extra-long pipes can be manufactured on the factory side, the installation period can be shortened.

## Applications

1. Clean water supply / Simplified water supply systems
2. Sewerage system
3. Agricultural water system
4. High pressure water supply / distribution systems
5. Supply / Distribution systems for various liquids



## Polyethylene pipe

- Availability of extra-long size
- Excellent flexibility
- High anti-seismic performance
- Superb ecological characteristics

# AQUALEX

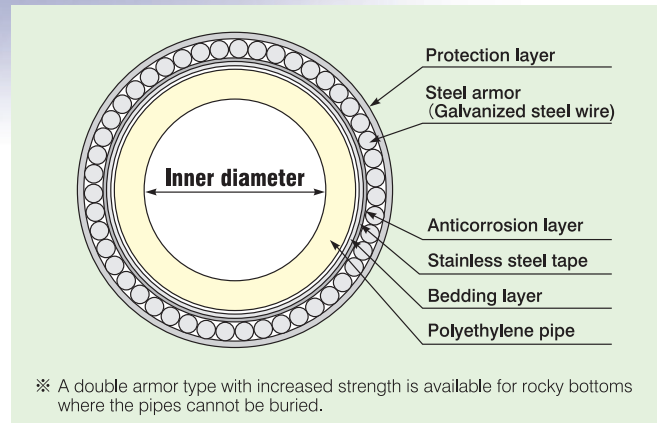
## Anticorrosion layer

- Weather resistance
- Anti-corrosion of steel armor

## Steel armor

- High damage resistance (tough)
- High bottom stability
- High mechanical strength (Resistance against tension / bending)

## AQUALEX Standard Type Cross Section



**Maximum operation pressure : 1MPa**

## Standard specifications (Operation pressure: 1MPa)

※ Specifications for higher operation pressure (above 1MPa) are available upon customer request.

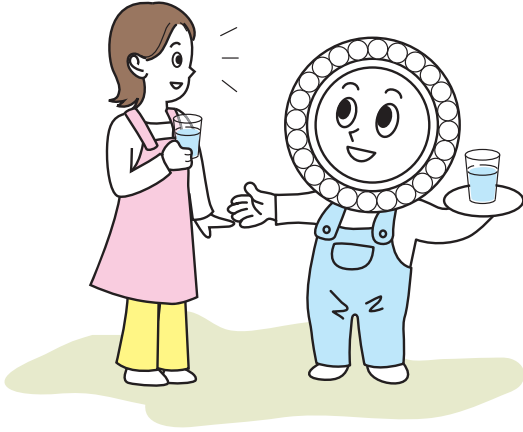
Nominal diameter	(mm)	50	65	75	100	125	150	175	200	225	250
Polyethylene pipe inner diameter	(mm)	50	65	75	100	125	150	175	200	225	250
Polyethylene pipe wall thickness	(mm)	5	6.5	7.5	10	12.5	15	17.5	20	22.5	25
Stainless steel tape thickness	(mm)	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6
Galvanized steel wire	φ (mm)	6	6	8	8	8	8	8	8	8	9
	(unit)	36	43	39	47	59	70	81	93	104	103
Protection layer thickness	(mm)	4	4	4	4	4	4	4	4	4	4
Overall diameter	Approx (mm)	86	104	120	150	180	210	240	271	301	333
Approximate weight (Vacant weight)	Approx (kg/m)	11	15	21	28	36	45	54	65	74	92

These products have performance satisfying the JIS K 6762 requirements for double wall polyethylene pipes for water supply.

# Features

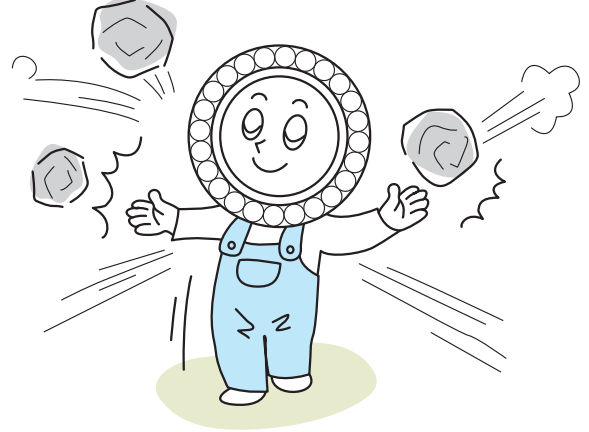
## No corrosion

Eco-friendly high density polyethylene is used for the inner duct of the submarine pipe to prevent corrosion by sea water.



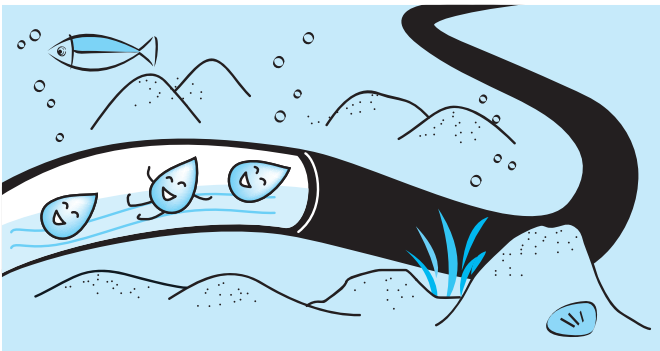
## High mechanical strength

Because of sufficient wall thickness of the high density polyethylene pipe and a reinforced structure based on stainless steel tape and steel armor, our pipes have high mechanical strength and weight that ensure stable installation within the submarine environment.



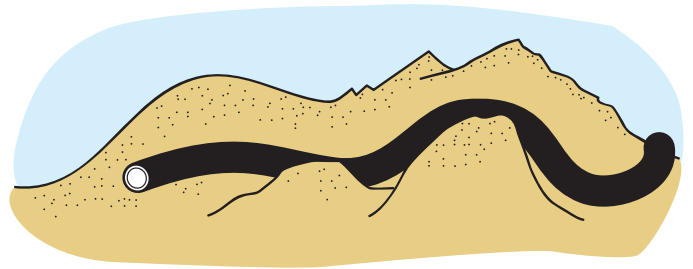
## Constant flow rate

Because the inner surface of the polyethylene pipe is very smooth, there is no change in the flow rate of water supply due to scale adhesion.



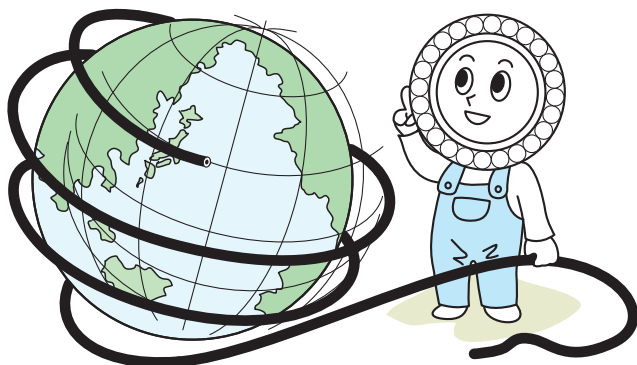
## Excellent flexibility

Our pipes can be installed stably on corrugated submarine geometry or in a curved route. This makes it possible to bypass rocks or coral reef where pipe protection is difficult. Due to the reduction of protection works on rocks or on coral reefs, installation can be performed in an eco-friendly manner.



## Long continuous-length product

Because the water pipes are manufactured in a special plant, where direct loading of the produced pipes onto an laying vessel is possible, pipes with extra-long size can be manufactured and installed. Since jointing of the pipes during installation is not necessary, the installation period can be shortened.



## Special types

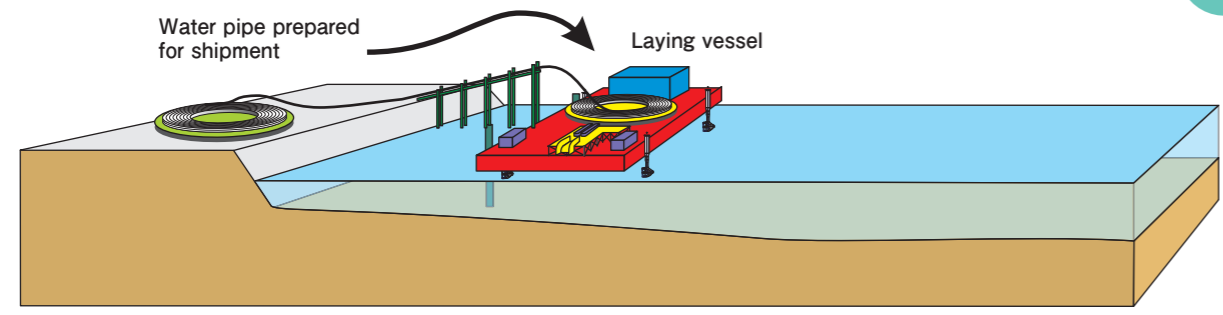
Because these submarine water pipes are designed by our design team, we can manufacture products with special specifications, including high pressure types and those for oil / chemical applications. Also, our special pipes have been adopted as replacement oil pipes in petrochemical complexes and deep sea water suction pipes.



# Installation

1

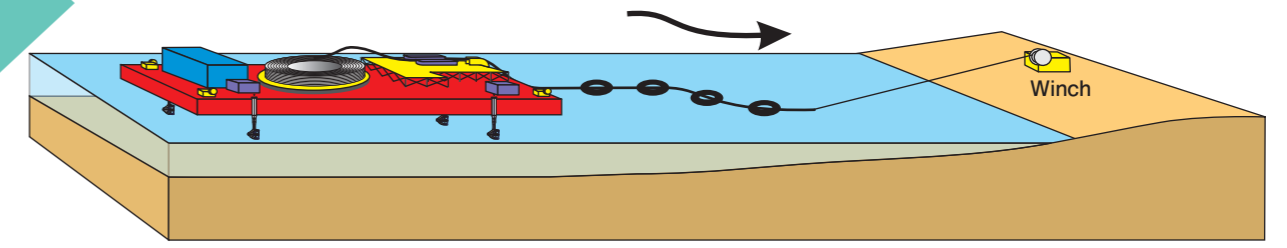
## Shipment of water pipe



Water pipe is loaded on a laying vessel from Furukawa's Chiba Works.

2

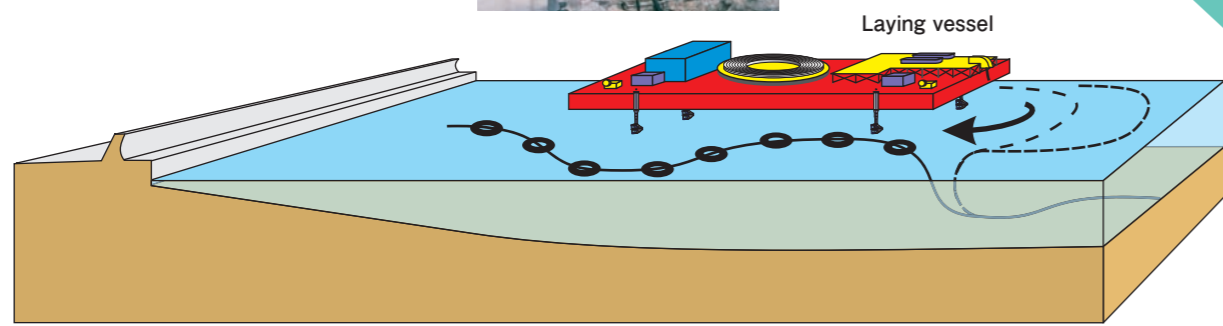
## Landing (starting end)



Laying vessel delivers the pipe from Furukawa's Chiba Works to the installation site. After preparation work, the vessel is moored offshore and one end of the pipe is landed by using a winch on the shore. During the landing, tube buoys are attached to the pipe for floating on the sea surface.

4

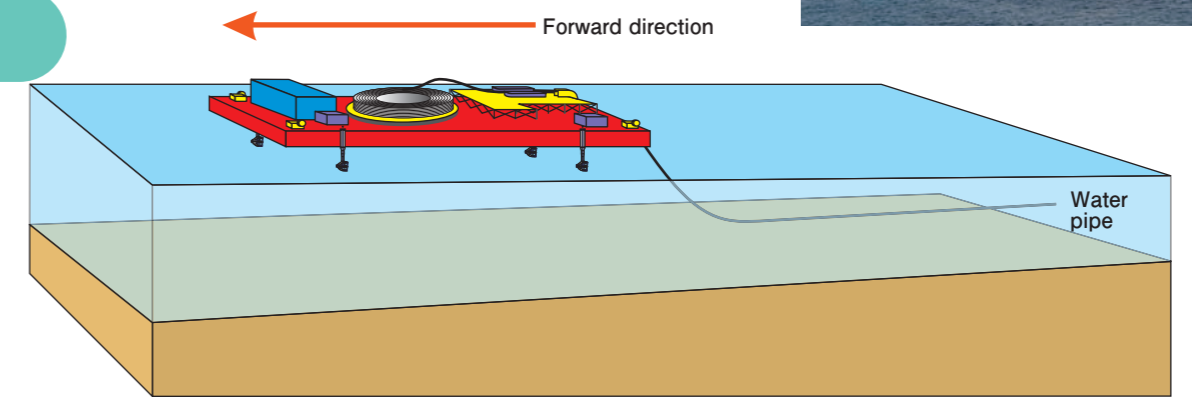
## Landing (finishing end)



Upon arrival of the laying vessel at the landing site of the destination shore, the water pipe is attached with buoys for buoyancy and landed, like as the landing of the starting end. After landing the pipe to a specified location, buoys are removed and the pipe is installed along the planned route.

3

## Water pipe installation (across strait)



While the laying vessel is moving forward, the water pipe is laid on the seabed. The location of the laying vessel is monitored precisely by using D-GPS etc., so that the pipe is installed properly on the planned route.



# Protection

Most failures of the submarine water pipes have been attributable to external damage. Accordingly, the appropriate selection of the protection method drastically increases the reliability of the pipe. Furukawa Electric proposes an optimal protection method based on its long experience.

## Beach and shallow water areas / Burying in trench

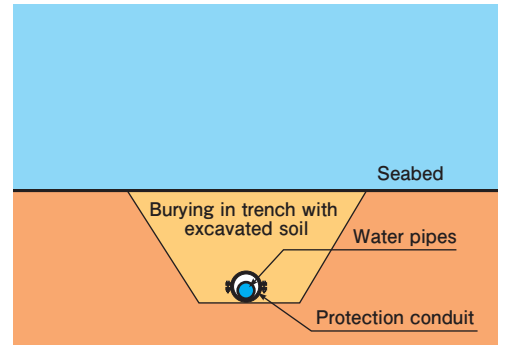
The burying-in-excavated-trench method is generally used in beach and shallow water areas where waves cause significant impact. Trenches are excavated by a grab dredger or backhoe and the water pipe is laid and buried in the trench by using the excavated soil.



Excavating a trench



Trench



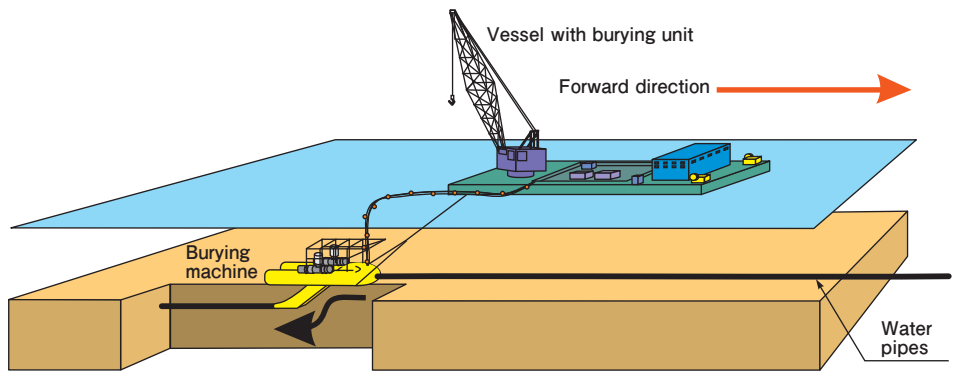
Pipe buried in trench

## Sedimentary layer area / Continuous burying

A continuous burying machine is generally used in the sedimentary layer of seabed, comprising sand or soil sedimentations. Different types of machine are used depending on the seabed soil condition; the water jet type is used for excavating sand with water jets while the chain cutter type has been developed for hard soil.



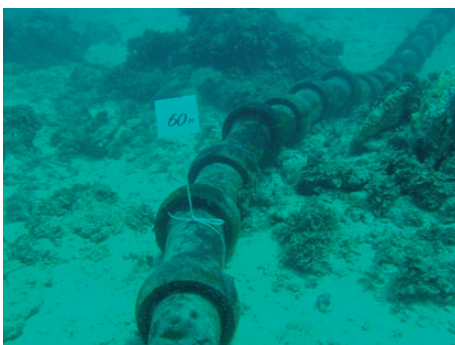
Water jet burying machine



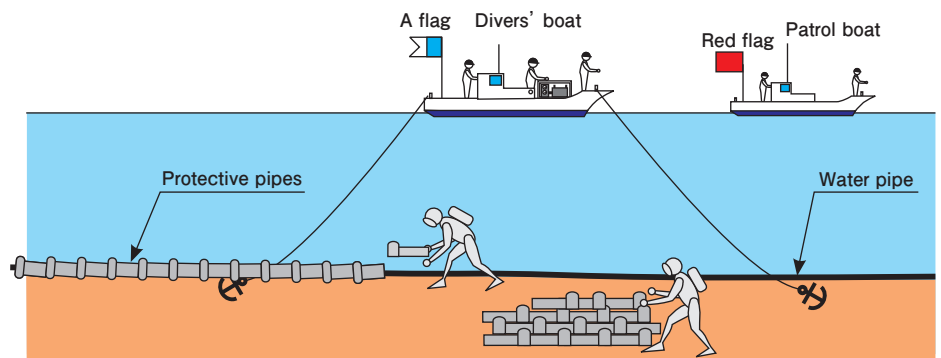
Continuous burying with a burying machine

## Rock area / Protection pipe application area

Socketed split protective pipe is used generally for rock areas where excavation is difficult. Divers apply protective pipes to the water pipe.



Water pipe with protective pipes

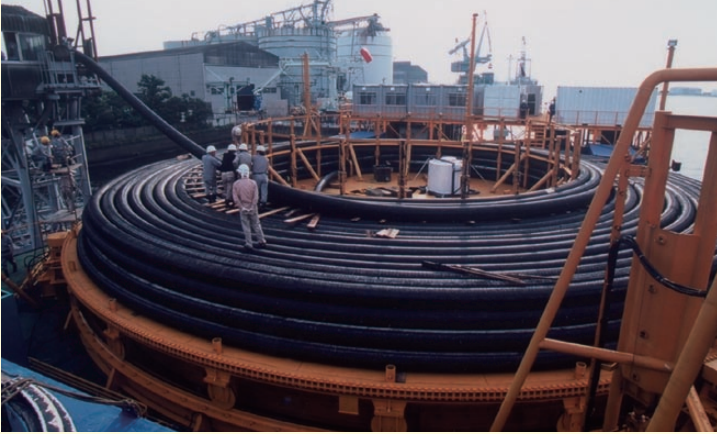


Protective pipe application

## Construction Equipment

In addition to various special machines and equipment necessary for the construction of a submarine water pipe system, Furukawa Electric has long experience of design and construction management in this field. Furukawa Electric is one of the first domestic developers of the burying machines. Its chain cutter type machine for hard ground applications performed submarine excavations as deep as 7m from the sea bed.

### Turntable (Water pipe transportation / Installation)



#### Application details

This turntable can load extra-long water pipes non-stop, then transport and store the pipe. The water pipe can be taken up directly from the manufacturing site to the turntable, transported to the installation site on a vessel and installed.

### Braking equipment (Water pipe feed / Control of the installation speed)



#### Application details

This unit feeds the water pipe corresponding to the installation speed. It is an important part of our system in managing the position and tension of the pipe.

### Chain cutter burying machine (Water pipe burying)



#### Application details

This unit buries water pipe continuously in the seabed. By towing the burying machine during installation, the water pipe can be buried at a specific depth simultaneously.

## **Caution in handling**

- The pipe materials described in this brochure shall not be used for applications that are not specified by the manufacture. Further, they shall not be installed with methods that are not specified by the manufacture.
- Operation conditions (temperature, pressure, etc.) of the pipe materials described in this brochure are specified by the manufacture and shall be used within the range of these operational conditions.
- Because the pipe materials described in this brochure are mainly plastic-based, users shall comply with the following directives:
  - Please avoid exposing the polyethylene pipe to fire to avoid the risk of deformation or fire.
  - Please take sufficient care in handling to avoid the product becoming damaged during storage, transport and installation.
  - Please avoid applying or spraying organic solvent or chemicals. These substances may cause material deterioration.
  - In designing and installing the water pipe system, please consider potential countermeasures against temperature-related dimension changes and water hammer.
- Disposal of waste shall comply with local rules and regulations.
- The Furukawa Electric Co., Ltd. shall not be responsible for damages caused by incorrect or inappropriate use.



<http://www.furukawa.co.jp/aqx/english/>

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