All content of this installation guide is taken from ASTM1759, ISO13272 and ATV127 standards which the first two standards are the basic national standard of Iran and the ATV standard has been used in order to calculate the installation, sort of backfill and data bases used in projects.
Since the Kish Pars Ethylene Company is proud to participate in standard development committee, it has been tried to consider the Iranian National Standard cases not only in the installation and implementation, But also during the production and design issues of manhole in order to supply a reliable, long life production.

Raw materials used in the production of polyethylene manhole:

Materials used in the production of Pars Ethylene Kish Company's manholes are from polyethylene material with 3840 grade and also it can be used from HDPE or LLDPE materials with rotary molding grade for producing polyethylene manhole.

However, due to conformity of raw materials refineries of the country with the standard used in producing polyethylene manholes, we can also use from HDPE 3840 or MDPE3840 materials in order to produce it.

In order to seal different parts, it can be used from the seal strip made of EPDMT which is very resistant to acidic or alkali materials in the wastewater streams, meanwhile, the bolts and nuts and washers used in this product are made of heated galvanized.

Polyethylene materials used in the Company's polyethylene manhole productions are very resistant to the sewage pollutants such as different acids with concentration even up to 99% and also concentrated alkalis. There is a list of materials that polyethylene is resistant to them which shows the resistance rate and operating temperature of the polyethylene in regard to these materials. Polyethylene materials are totally resistant against wear and corrosion due to erosion and exposure of suspended solids in sewage and they are also long life.

The polyethylene raw materials would not be removed or corrodes by clashing with suspended solids in invests due to their shock absorbing properties.

Since polyethylene manholes are sealed completely by the sealing strips, it prevents subsurface waters to the sewer system and vice versa ,so the manholes do not allow sewage materials to penetrate underground aquifers and in this regard, it is very suitable for sewage system

performance and it can prevent groundwater pollutions. Concerning this, it is totally suitable for environment.

Characteristics of raw materials used in the production of polyethylene manhole of Pars Ethylene Kish Company

Property	**unit**	**value**
Density	Gr/cm3	0.935-0.939
Melt Index	Gr/10min	3.8-4.5
Flex	Mpa	650
Strength	Mpa	Min 15
Impact Strength	Kj/m2	Min 18

Operating temperature of the polyethylene manholes are defined between-450C-600C according to fluid temperatures. Polyethylene manholes are used for gravity flows, though in tests and some operations, it is needed a slight positive pressure or negative pressure within manholes which can handle these pressures. However, it is recommended to consult with the manufacturer if manholes are used in other applications or special cases.

Anti-UV materials:

According to Iran's national standard, polyethylene manholes must have outdoor durability at least a year. So the polyethylene manholes must be resistant to UV rays of sun. 3840 Polyethylene materials produced by refineries have anti-UV additives and do not require adding more resistant materials such as Carbon Black. Since Pars Ethylene Kish Company uses

the100% of raw materials (Virgin Material), no ingredients added to it in this regard, so the physical and mechanical properties of materials can also be preserved and there is a 100% of monotony distribution in these products.

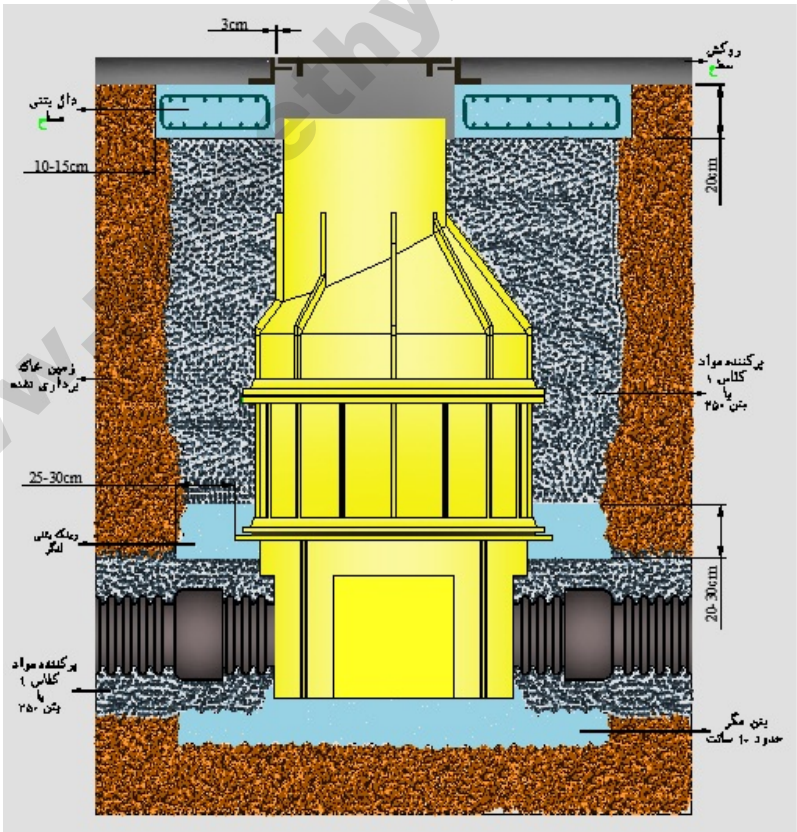
Polyethylene manhole Installation

Foundation:

Polyethylene watering places should be placed on a firm and prepared floor. Large pieces of rubble must be removed from the trench floor after excavation. Then the floor level is done by usage of class I soil (according to ASTM2321 standard) that is well balanced and completely mashed with (95% density) and about 30 cm thickness.

According to its suitable standard, we use from a stable or pre-made concrete slab with approximately 15 cm thickness.

In areas where the excavated floor (trench bottom) has loose soil or groundwater level is above the manhole base or we are encountered with saturated soil, we must use a concrete slab which is pre-made and installed at the bottom of the trench.



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In areas where the soil is very loose and we are encountered with landfills, it is recommended to remove an amount of soil from the floor and replace it with suitable soil, and then the above-mentioned steps are performed. These cases must be done by engineers and consultants opinions.

Since the transferring of dead and live and also pressing forces are dragged down at the base of manhole, the equipments must be considered in order to prevent soil seeping and the base where the manhole is established must be well prepared.

Backfill:

According to ASTM1759 standard, we must have a mashed soil of class I with approximately 90% density till one-meter radius around the watering place.

Therefore, in locations where these operations can be done, we must pour the backfill soil around the manhole equally (about 20 cm) in layer form and then accumulate it monotonously. We must be careful the soil is started from the wall and is continued until trench parapet and it must be balanced and layered not to make manhole deviate from balance line and it must be continued until the top and base of installation place.

In areas where there is no possibility to open the trenches and the soil is intact and contains soil properties of class I with the desired density, manhole sides can be opened less (about 30-20 cm) and if there is no possibility of soil compaction, we must use substituting materials which can reach to desired density after hardening.

According to the calculations which is done by the help of ANSYS software and Finite Element method by Pars Ethylene Kish Company and considered through frequent meetings with Water and Wastewater Organization experts, there has been gained significant results in order to replace backfills with the above-mentioned soil reached to the desired density easily and also it is able to endure different loads. This material is the one which is presented by the America Cement Association (ACF) and it is very close to the low-substance concrete (Megr) C10 and CLSM materials.

Low-strength concrete (CLSM) is a cementitious and self- absorbed material which is used as backfill instead of mashed soil. According to CLSM ACI-116R standard, these materials have compressive strength of 8.3 MPA or less. Most of low-strength concretes have compressive strengths of 2.1 MPA or less and the basic usage of this material as backfill is in the absence of

mashed soil in limited places. Since there is no need to grind surrounding soil, trench width or size can be reduced.

The mixture of this low strength concrete includes water, cement, tiny and large backfill materials or both of them. Although the materials used in this mixture have the CLSM standard, it is not necessary to use standard mixtures in order to produce it. Compound materials are chosen when they are affordable and based on requiring qualities like strength, fluency and density.

Cement

Most of Portland cements type I and II are used based on ASTM C150 standard. Other cements can be used according to an appropriate ASTM C595 test results.

The additives

Adding materials contain air or foam to the concrete mixture cause to improve working condition, shedding reduction, reduction of concrete voluminal mass and control of the ultimate resistance.

Water

Water used in current concrete mixtures is based on C94 ASTM standard approved for making this material.

Fillers

Considering that most manufacturers have filler concretes based on ASTM C33 standard in store, the same materials are used for making low-resistant concrete. Other fillers which are used successfully in making this type of concrete can be also manufactured according to ASTM C34 standard.

Sand and gravel

Fillers with less than 19mm sizes beside sand and gravel

Sandy crude soils with less than 15% and larger than 75mm sizes

Quarry remainder products with less than 10mm sizes

The suitable fluency is gained in result of inseparable conditions based on ASTM D6103 standard which is obtained by spreading the concrete with at least 200mm thickness. Fluency conditions of this material are as follows:

Low fluency: less than 150mm

Normal fluency: between 150 to 200mm

High fluency: larger than 200 mm

Resistance:

The compressive resistance is between 0.3 to 0.7 MPA equal to the soil which is well mashed. The resistance of this material would be increased to 8.3 MPA after 28 days.

Density:

The density of a normal low-resistant concrete is between 1840-2320 kg/m3

Shear modulation:

according to the density, the normal shear of a low-resistant concrete is between 160-380 MPA

Compatibility with plastics

Low, normal and high density polyethylene materials used for underground equipments are fully compatible with this concrete.

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The combination of materials ratio

Cement: The combination ratio used in this material is 30-120 kg/m3. The cement ratio increase cause to raise resistance and reduce hardening time.

Fillers: the usual combination ratio of the concrete is 1500-1800 kg/m3. Most of the time, we use fine-grained fillers.

Water: Water can increase fluency and curing concrete. The usual ratio used in this material is 193-344 kg/m3.

The suggested combinations for reaching 0.4 MPA resistances are as follows:

Cement: 30kg/m3

Coarse-grained filler: 1010kg/m3

Fine-grained filler: 1096 kg/m3

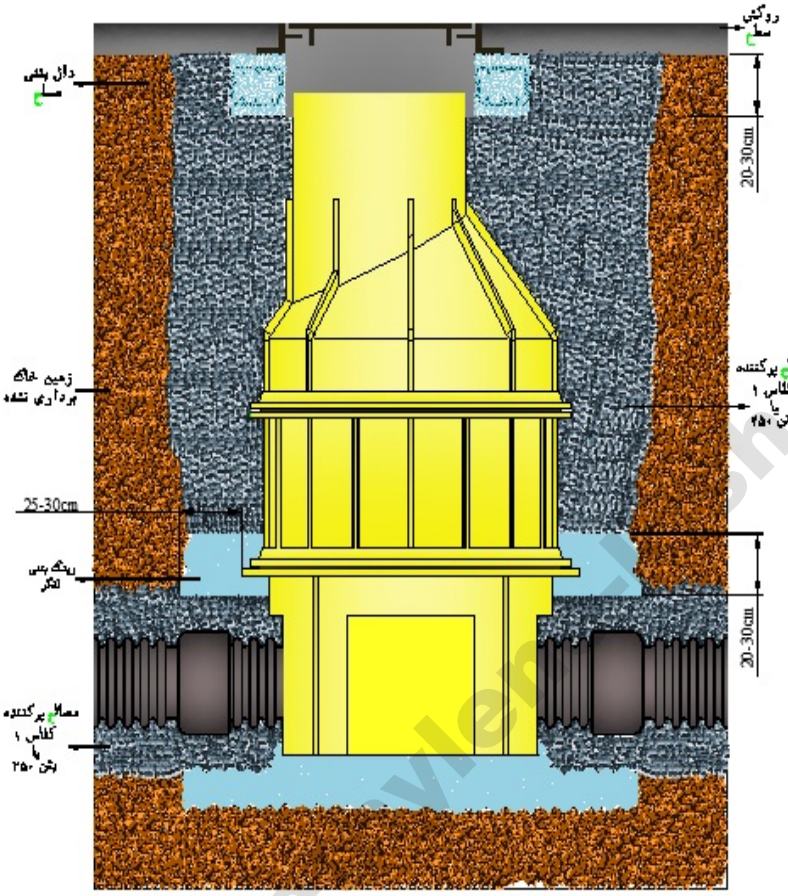
Water: 193 kg/m3

According to these calculations, Pars Ethylene Kish Company's manholes with reinforced parapets of polyethylene rings with10 mm thickness can easily handle dead and live loads up to (40 ton) with 6 safety coefficient. This tolerance can be achieved in case it is used the provided instructions order to install the manhole. It is important to note that in accordance with standard, if the polyethylene manhole project is done in a place where support soil (Surrounding soil) does not have enough resistance like landfills or places where the soil is very loose and soft, the engineers and consultants should plan an appropriate design.

Vehicular load

According to standard, polyethylene manhole must tolerate the dead and live weight of several people and some equipment on it. For example, if manhole is installed in the pavement, it must be able to withstand the loads alone. If there are heavy live loads especially live vehicular loads, in accordance with standard we must use a concrete slab on top of the manhole.

The concrete slab actually serves as a slab bridge which expands the concentrated loads from one side. Therefore, the concrete slab must be larger than the diameter of manhole, therefore rely on the surrounding soil.

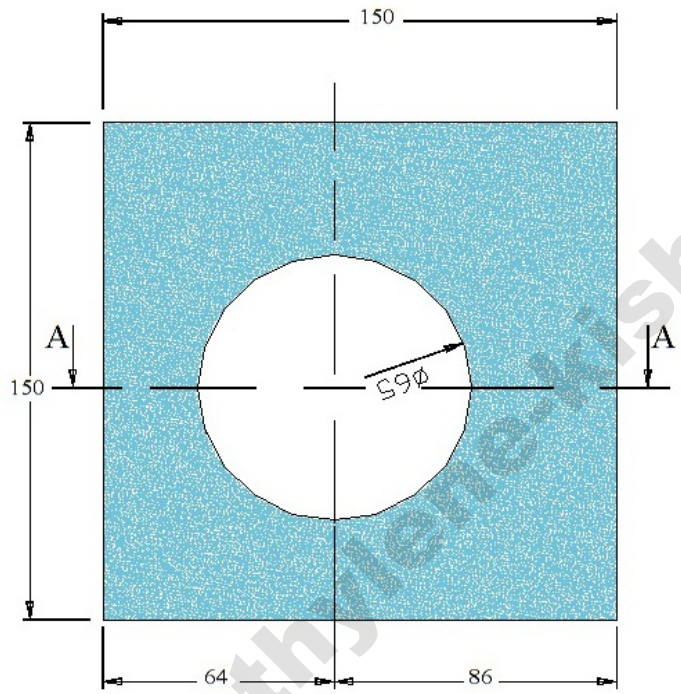


Concrete slab

Depending on the amount of incoming vehicular load, its size and especially thickness is calculated. In more than 40 ton levels, the slab thickness of 25 cm and in lower, the 20 cm thickness should be considered .The slab is built in a flat shape (Reinforce Concrete) by using the 350 cement and usually in square form.

The concrete slab figure for a manhole with 1000 mm diameter

MANHOLE Dmm1000



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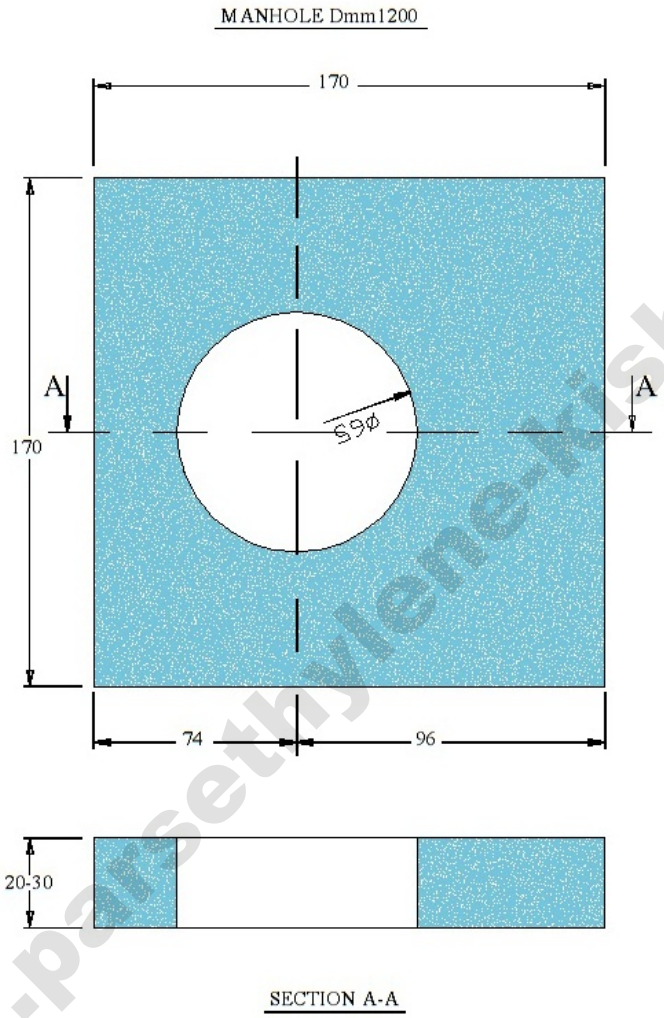
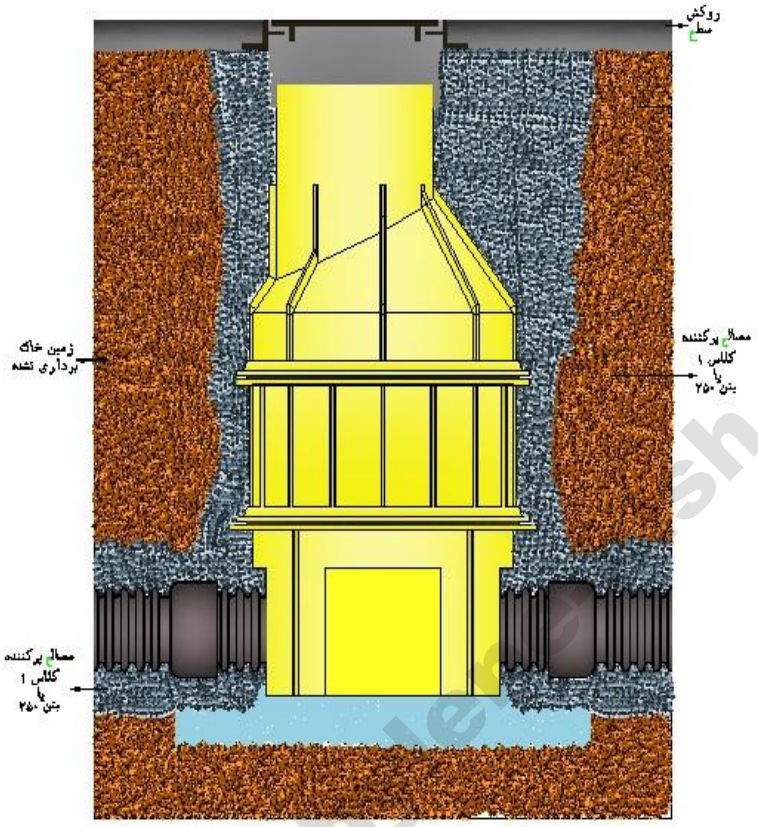
The concrete slab figure for a manhole with 1200 mm diameter



The special manner of manhole shutter placement

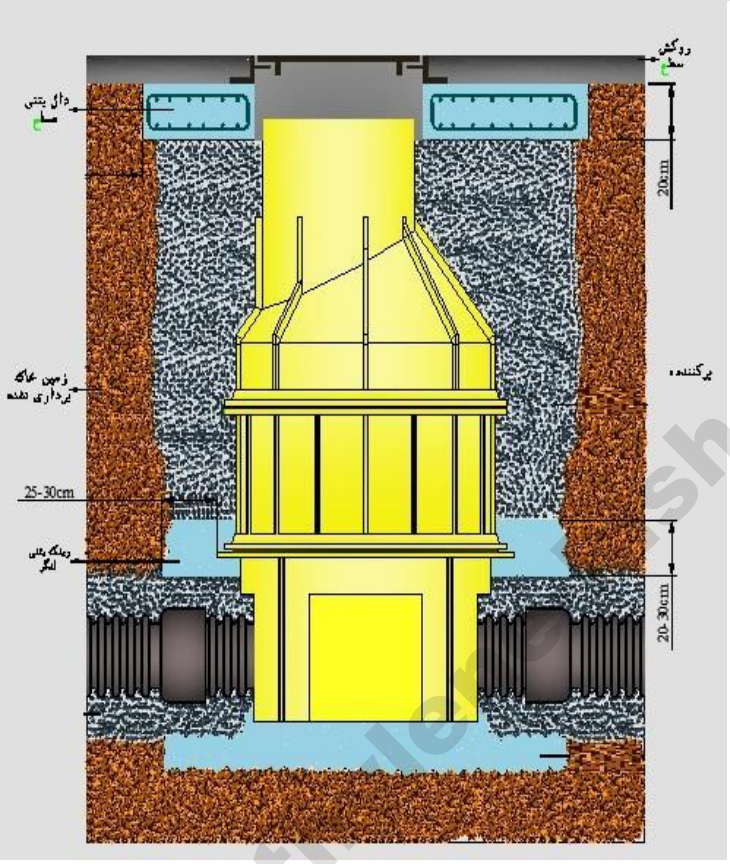
The important point in polyethylene manhole installation is the placement of shutter .According to the following figure, it should be noted that the manhole cover must be placed on concrete slab and it must never placed directly on the polyethylene manhole. This causes the concentrated loads on the hatch transfer into slab concrete and the slab transfers them into the surrounding soil (Backfills) and trench parapet, too.



Surface waters:

If the water level comes up from the bottom of manhole, even temporarily, then the buoyancy force is imported to the bottom of manhole by water .If the buoyancy force is more than the weight of manhole, its attachments and friction force of surrounding soil with manhole, it may push the manhole upwards and remove it from the place.

The buoyancy force can be controlled in several methods. According toASTM1759 standard, manhole must have a solid ring in the base called Anchor Key. It can be used to anchor manhole and prevents manhole floating.



The first method:

After connections installed and manhole balanced, surrounding soil with proper compaction must be layered monotonously around manhole. Within the limits of 10 to 15 cm to anchor key on the mashed soil, we pour 250 cement in order to ensure that the cement has penetrated under anchor key and then we fill at least 20 cm above the anchor key with cement until cemented slab controls one side of the manhole by the help of anchor key and in another side, it hooks itself to trench, so the slab weight prevents the buoyancy force at the same time.

The second method:

In places where the ground water level is too high such as north and south parts of the country, we must pump the water out immediately after excavation and after the manhole base and connections installation, the anchor key is filled by the use of 250 cement from the bottom to at least 30 cm and wait the cement becomes curing and then we must continue the rest of work. It is better to use 150 concrete which is covered around the manhole about 30 cm.

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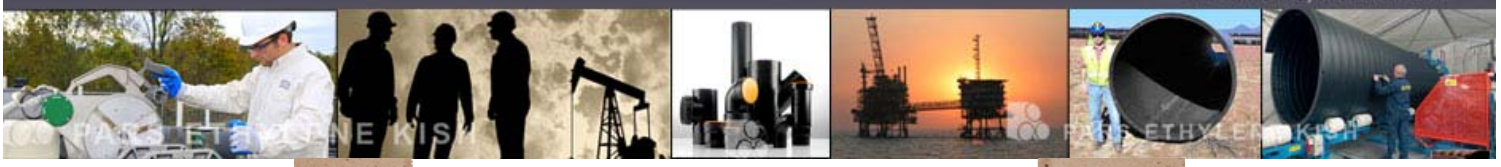

Polyethylene manholes sizes and dimensions

Polyethylene manholes are produced in two sizes of 1000 mm (manhole base diameter) with 6.5 to 85 m height and 1200 mm (manhole base diameter) with 8 to 120 m. It is recommended to consult with Pars Ethylene Kish Company's sales agents for polyethylene manholes orders.

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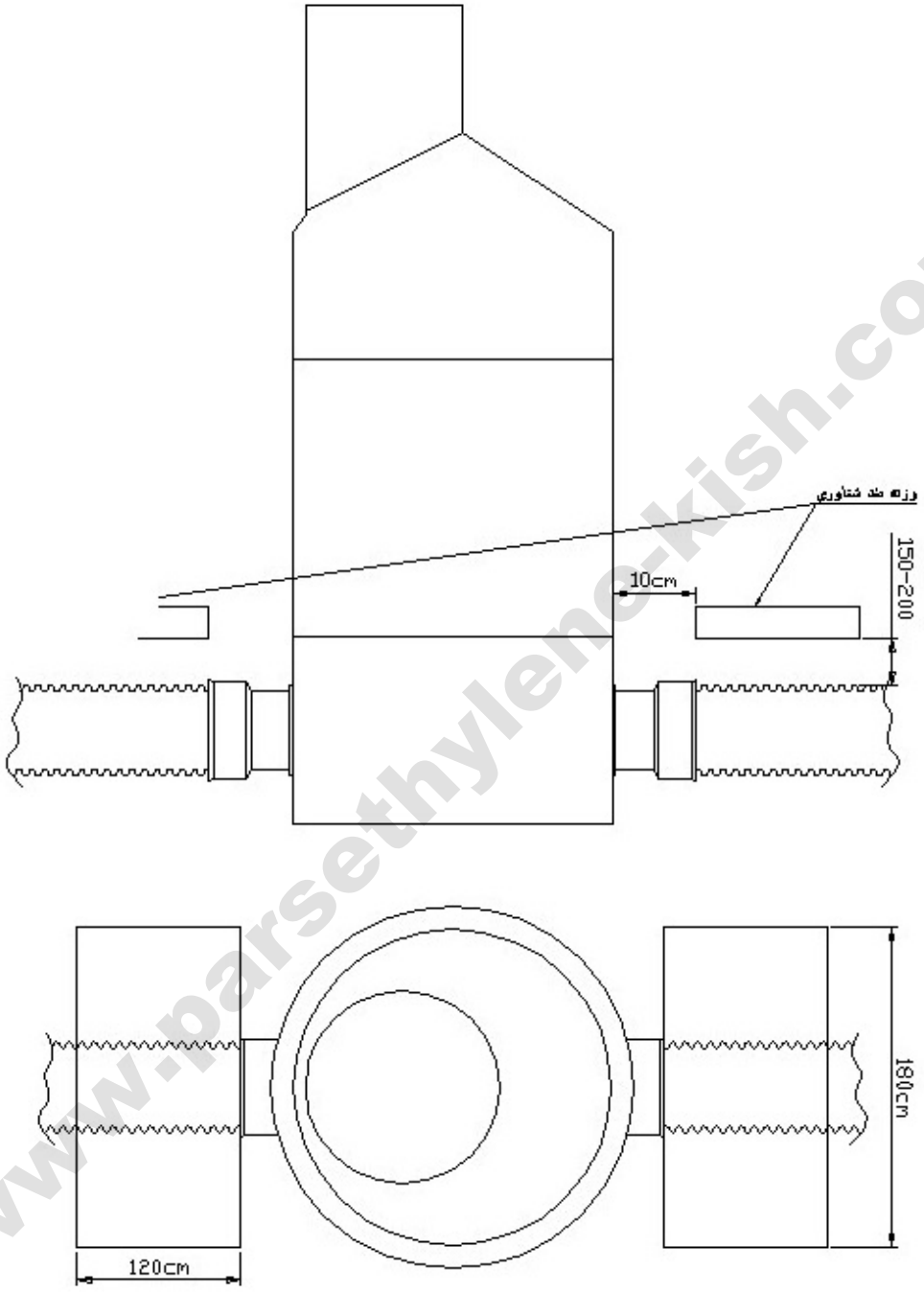

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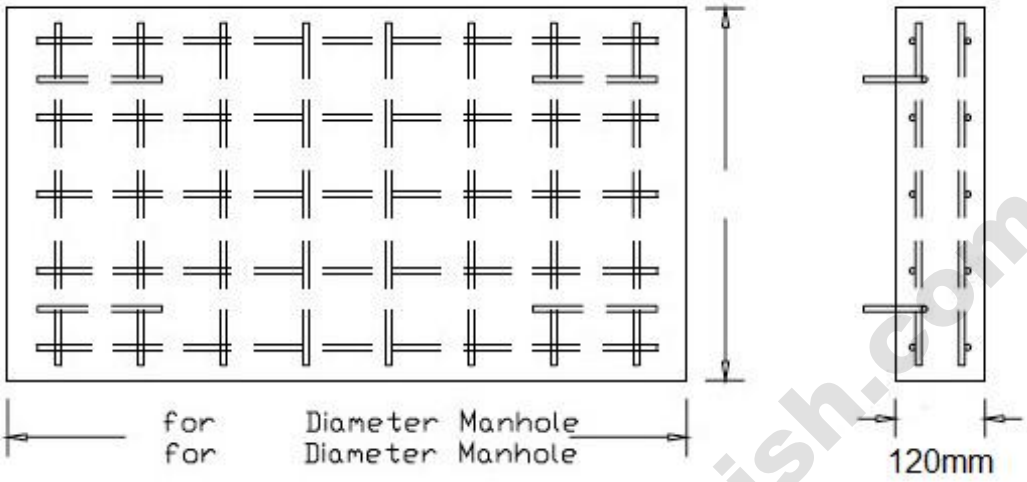

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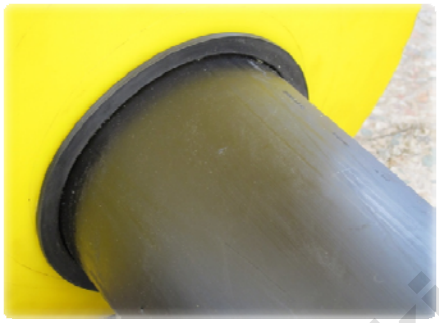
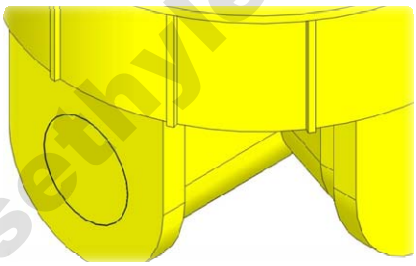
The method of single pipe parietal connection into the polyethylene manhole (manhole interior part)

As it can be seen in figure 1, polyethylene single pipe parietal connection to polyethylene manhole must be done so that a complete seal occurs.

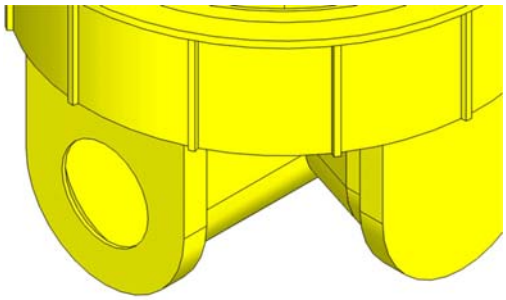


In order to reach standard conditions for polyethylene single pipe parietal connection into the polyethylene manhole, the exact place of interior and exterior parts must be determined and before the installation, the interior and exterior parts must be drilled on manhole frame.



This hole is caused by means of an instrument which cuts circularly or a saw which cuts in column form on a polyethylene manhole parapet. This hole in accordance with pipe external diameter beside required tolerances for installation of the sealing washer as the following formula:

Drilling diameter on manhole frame = pipe external diameter + 10 mm for the rubber washer



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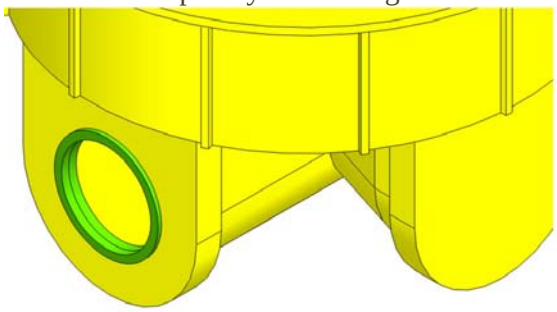
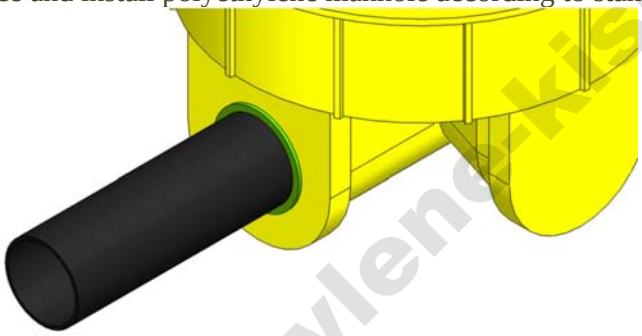
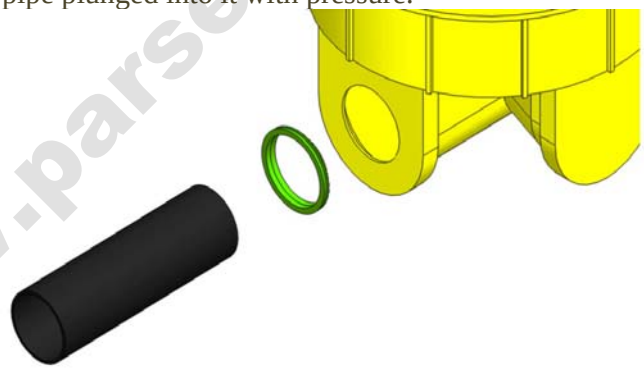
Then we install the sealing washer on the polyethylene manhole parapet. It is necessary to cleanse around the hole completely from filings before installing the rubber washer.



After completion of drilling and putting all washers for required interiors and exteriors, we should place and install polyethylene manhole according to standard instructions.



After fixing polyethylene manhole and installing it, the interior and exterior pipes must be installed at its place .To do this, first the washer must be lubricated with lubricants and then the pipe plunged into it with pressure.



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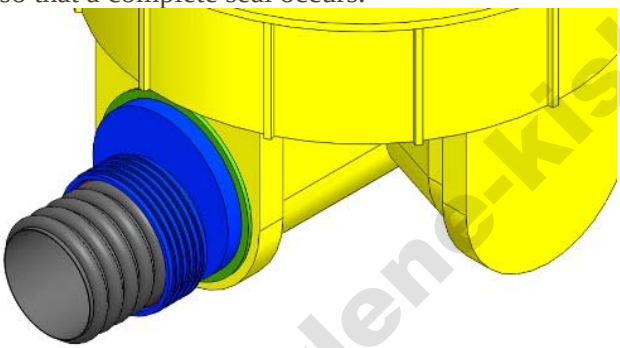
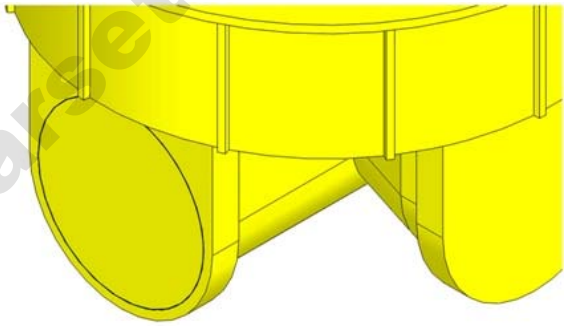
The method of single pipe parietal connection into the polyethylene manhole (manhole exterior part)

We must use replacing connection for polyethylene manholes exteriors parts in sewage systems. Replacing connections are used due to the presence of coarse and fine particles and in the polyethylene manhole exterior part and the exterior parts required to be at the maximum diameter since the suspended particles do not stick on pipe and exhaust pipe and accessories in exterior part. It is necessary to consider a maximum of 400 diameters for Carogate pipe exterior hole. The installation of this system is as follow:

As it can be seen in figure 1, polyethylene single pipe parietal connection to polyethylene manhole must be done so that a complete seal occurs.



In order to reach standard conditions for polyethylene single pipe parietal connection into the polyethylene manhole, the exact place of interiors and exteriors must be determined and before the installation, the inlets and outlets must be drilled on manhole frame.



This hole is caused by means of an instrument which cuts circularly or a saw which cuts in column form on a polyethylene manhole parapet. This hole in accordance with pipe external diameter beside required tolerances for installation of the sealing washer as the following formula:

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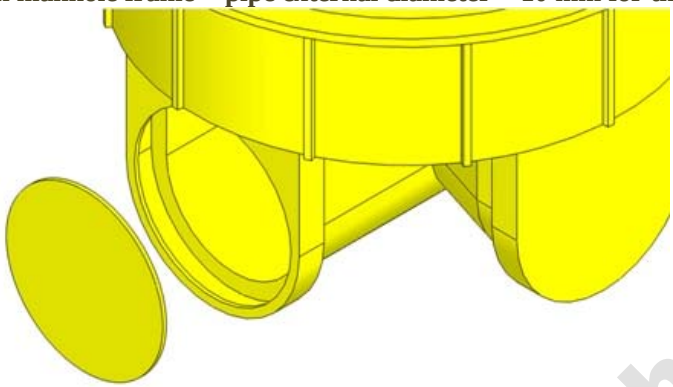

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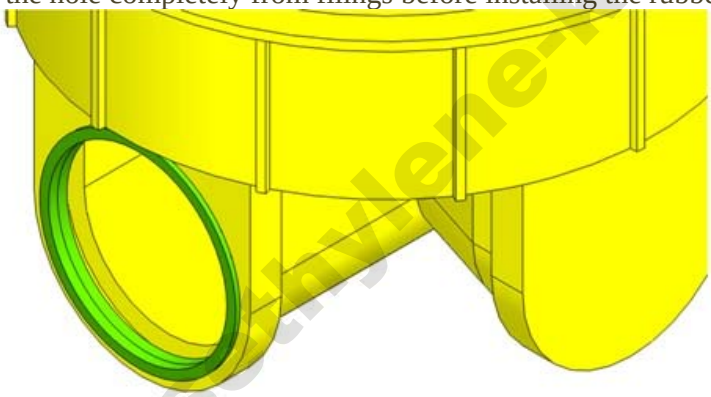

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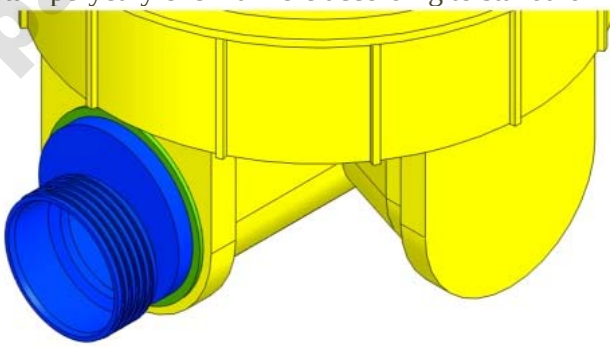

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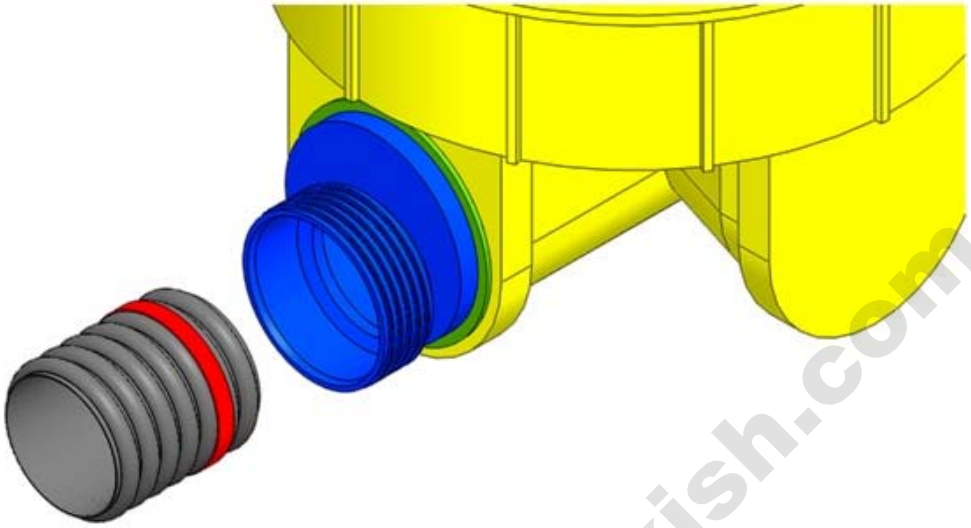

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