

KANTAFLEX SEALING GASKETS FOR TUNNEL SEGMENTS



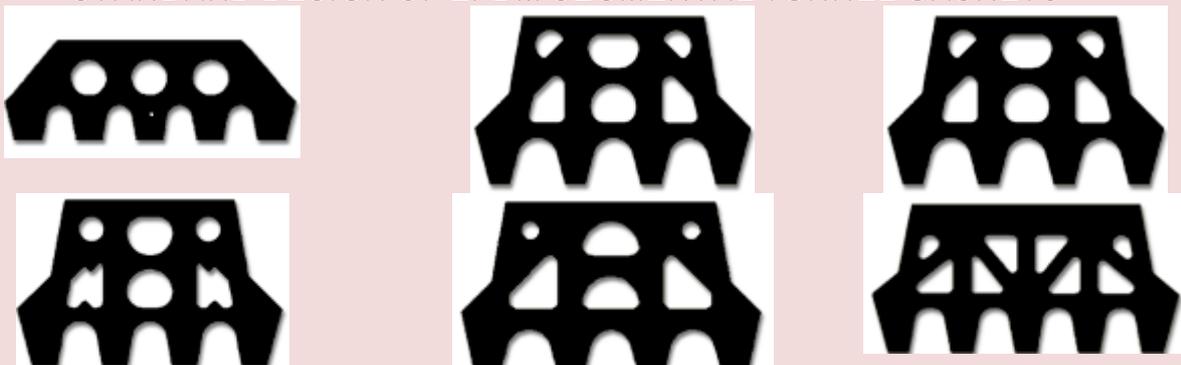
It is a gasket made out of generally EPDM rubber, provided in tunnel segments and working as water proofing seal

It is essential that the tunnel has to be waterproof to ensure minimum maintenance and operating safety as well as to protect the expensive electro-mechanical installations housed in the tubes. Depending upon the height of the water pressure, the sealing gasket is to be designed and the rubber gasket shall be long lasting.

TO ACHIEVE 100% WATER TIGHTNESS

- Maximum allowable gap shall be determined.
- Off – set between two segments shall be determined.
- The distortion in the radial joints (ring build tolerances) shall be limited.
- The segment tolerances for profile and groove shall be limited.
- The EPDM gasket shall be in function for life span of the tunnel, about 100 years.

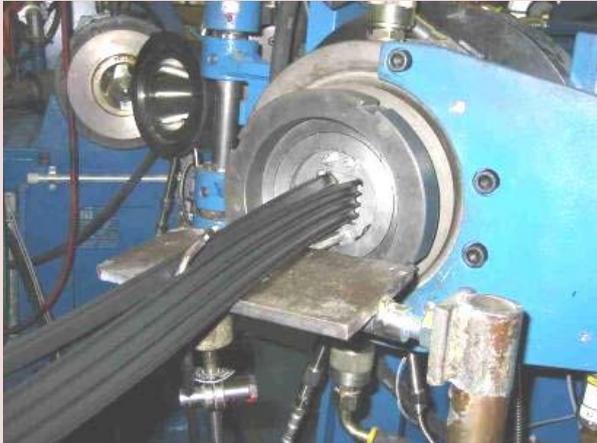
STANDARD DESIGN OF EPDM SEGMENTAL TUNNEL GASKETS



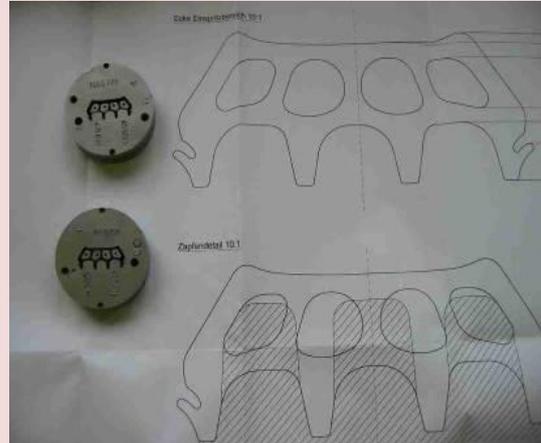
NOTE: ANY DESIGN CAN BE DEVELOPED DEPENDS ON SEGMENTAL GROOVES

METHOD OF MANUFACTURING

It is an extruded profile. The standard gaskets are mono – extrusion with only rubber extruder forming the required gasket shape. In latest technology, and in order to get higher performance hydrophilic strip is co-extruded which means that the EPDM rubber profile and hydrophilic strips are simultaneously extruded and jointly vulcanized.



Extrusion Machine



Profile design

PHYSICAL PROPERTIES OF THE EPDM RUBBER

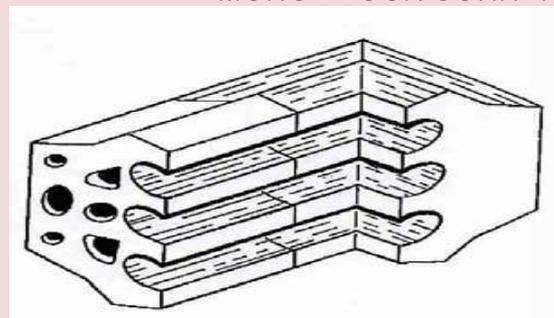
| | |
|---------------------|--------------------------------|
| Shore Hardness | 55 to 65 in IRHD |
| Tensile Strength | 120 Kg/cm ² Minimum |
| Elongation at break | 300% Minimum |
| Tear resistance | 25 Kg/cm |
| Water absorption | 1.0% Maximum |

| |
|---------------------|
| 55 to 65 in Shore A |
| 1700 PSI minimum |
| 300% Minimum |
| 45 lbs / inch |
| 1.0% Maximum |

There is a possible leakage in corner area of the gasket frames, i.e., at T joints of the tunnel segments. Pre-cut gasket strips are vulcanized together to form a frame, are used in corner joints. In this joints the corner area will have more rubber than the segmental sides, resulting the corner will be more stiffer than the regular profile, which lead into improper load distribution and possible leakage, especially when - as it happens in the tunnel - two such stiff corners are compressed onto each other.

To avoid uneven load distribution as well as to get constant load deflection force along the whole segmental frame, new technology is adopted as VOLUME BALANCED CORNER VULCANIZATION.

MONO BLOCK CORNER



VOLUME BALANCED CORNER

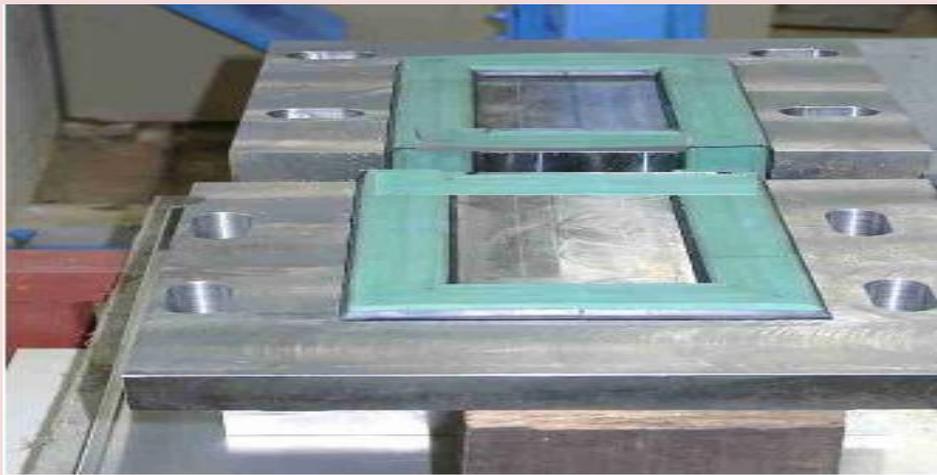


WATER TIGHTNESS TEST ON EPDM TUNNEL GASKET

The standard test procedure is now state-of-the-art and established in accordance with DIN-specification (Germany).

TEST RIG & TEST PROCEEDURE

The three-piece steel test rack replicates a T-joint with the 90° gasket frame corners that exist in the real tunnel. The steel pieces with the interior test gasket are tensed up with the help of screw bolts. The off-set is adjusted by moving the steel plates counterpart .The test rack is then closed and fed with water that is in accordance with the actual groundwater composition of the project. The design water pressure is applied in steps of 1 bar



OPEN TEST RIG WITH GASKET



WATER PRESSURE TEST EQUIPMENT

TEST LOCATION & TEST RESULTS:

Water tightness tests shall normally be carried out in our own R&D department and on-site tests can be avoided. To test the efficiency of the gasket profile against leakage the water tightness test with a required gap and off-sets is carried out. If the gasket is withstanding the water pressure is built up in steps of 1 bar and is hold there for 5 minutes the test found to be passed.

INSTALLATION PROCEEDURE:

The gaskets are delivered on site as prefabricated frames. The frame sizes are tailor-made and stay in accordance with the segment design. To prevent water circulation between groove and gasket, the gasket frame is glued into the groove of the segments. A safe application requires a clean groove surface. Before mounting the gasket, it further has to be checked whether there are cracks or chipping damages in the segment groove. Such damages have to be repaired as otherwise they could lead to unwanted and uncontrollable waterways.

Segmental grooves are to be applied with an adhesive prior to inserting the gaskets. Firstly, all four corners are pressed into the groove and aligned. It is important, that they are not distorted. As the gasket frames have a pretension, i.e. they are smaller than the segment groove length. The purpose of the pretension is to reach a tight fit in the groove.



After mounting the gasket, the tunnel segment can be stored outdoor. EPDM is not susceptible to normal weather influences such as sun and rain. But in case of co-extruded profiles with hydrophilic layer, the gasket should be covered with a plastic to avoid swelling before installation of the segments. Most contractors pile segments for a whole ring and protect this set with a plastic cover from possible rain.

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