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União Europeia
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QUADRO DE REFERÊNCIA ESTRATÉGICO NACIONAL
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AMORIM
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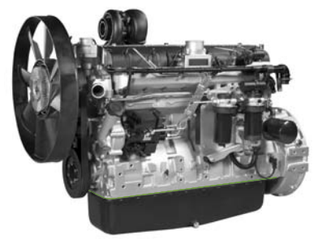
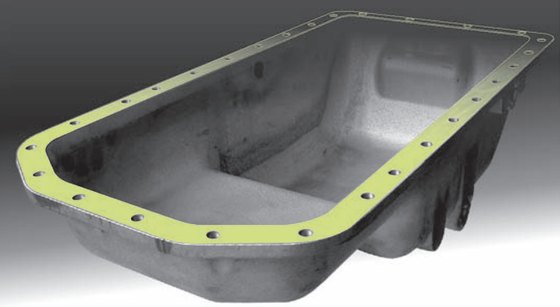
doc - ACC.453 September 08

HEAVY DUTY DIESEL SOLUTIONS

TechSeal®





AMORIM
AMORIM CORK COMPOSITES

Your Challenge.
Our CorkRubber Solution.

TechSeal®

The Quality Seal

Amorim Cork Composites has many years of experience in providing sealing solutions to numerous industries, developing know-how and technical expertise, anticipating market trends and "problem solving" with our clients.

TechSeal® IS THE NEW FAMILY OF PRODUCTS SPECIFICALLY DESIGNED AND TESTED FOR THE HEAVY DUTY DIESEL MARKET.

TechSeal® products are designed to withstand the application requirements of heavy duty applications, while providing our customers with manufacturing options that will assure a reliable finished component or engine.

Our product range will meet the application environment where contact with engine oil, gear oil, diesel fuel or biodiesel as well as coolants are required.

TechSeal® products are specifically designed for high distortion applications when stamped steel and plastic covers are to be used.

QUICK REFERENCE GUIDE

FLAT GASKET MATERIALS

KEY REQUIREMENTS	TS1400	TS1800	TS1308	TS7100	TS7110	TS7000[a]	TS1711[a]
High Temperature Resistance (°C)	125	110	125	110	135	175	135
High Load Bearing	+++	++	++	++	+++	++	+
Low Load Bearing	+	++	++	++	+	++	+++
B-100 Bio-Diesel	●	●	●	■	●	○	○
Diesel (low sulfur)	●	●	●	●	●	○	○
Engine oil (15W40)	●	●	●	●	●	●	●
Gear oil (75W90)	●	●	●	●	●	●	●
Hydraulic Fluids	●	●	●	●	●	●	●
MEG Coolant	●	●	●	○	●	●	○
OAT Coolant	●	●	●	○	●	●	○
PEG Coolant	●	●	●	○	●	●	○

(a) Not recommended for fuel contact
SAE AMS-C-6183 certified materials available upon request

■ Acceptable
● Suitable
○ Unsuitable

3D GASKET MATERIALS

KEY REQUIREMENTS	A041	A099
Compound	NBR	VMO
High Temperature Resistance (°C)	125	180
Low Temperature Resistance (°C)	++	+++
Oil Resistance	+++	++
Fuel Resistance	++	

CHARACTERISTICS AND ADVANTAGES

- TOLERANCE TO EXTREME SURFACE FINISHING CONDITIONS, SUCH AS "AS CAST".
- CONFORMABLE TO FLANGES WITH HIGHER "OUT-OF-FLATNESS" VALUES, SUCH AS STAMPED STEEL AND PLASTIC COVERS.
- LOWER BOLT TORQUES POSSIBLE.
- FEWER FASTENERS IN THE SYSTEM.
- SMALLER OR LOWER GRADE FASTENERS.
- COMPONENTS WITH LESS MASS AND MORE DISTORTION.
- STABLE DAMPING VALUES ACROSS THE FREQUENCY RANGE REDUCING VIBRATIONS EFFECTIVELY.
- EASY TO FABRICATE.

For recommended service conditions regarding gasket average loading and continuous working temperature please refer to our **Material Datasheets**.

Check our **"Q-Tool"** sealing software on our website for a quick and comprehensive calculation of your joint system, or contact us for additional help to define our best material solution for your sealing requirement.

TechSeal®

SEALING MATERIALS FOR HEAVY DUTY APPLICATIONS

A complete solution in one package

PRODUCT DEVELOPMENT & ENGINEERING SUPPORT

Amorim Cork Composites provides engineering support during your product development. Our testing facility is fully equipped for Verification & Validation of any joint system.

FEA analysis of the joint system using material aging prediction, is a tool that is available for our customers when working together in early development programs.

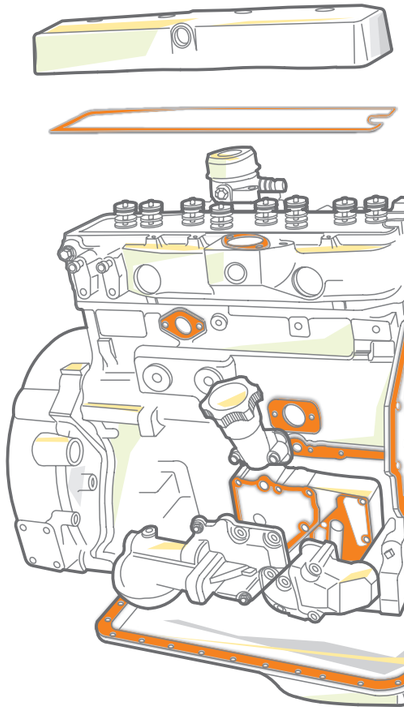
TECHNOLOGY THAT PAYS

Amorim Cork Composites products and engineering capabilities can provide you with a global advantage when it comes to designing your sealing system. Our systems approach offers you an overall optimized sealing solution.

READY FOR THE FUTURE

Amorim Cork Composites products have been tested and are compatible with the new E85 ethanol fuel, as well as B100 bio-diesel fuel.

Our products have also been tested for gasoline permeability and can be used to reduce your evaporative emissions levels.



APPLICATIONS INCLUDE:

- Powertrain
- Non-Powertrain
  - Gear & Chain Covers
  - Dust Covers

Several Amorim divisions are FSC (Forest Stewardship Council) certified. Recent studies in the Iberian Peninsula state that cork oak forest contributes with more than 20 Million tons of CO_2 retention, making it a significant world resource for the environmental balance.

Each time cork is harvested, cork bark regenerates itself. Cork oak trees store CO_2 in order to regenerate, and therefore a harvested cork oak tree absorbs 3 to 5 times more than one which is not harvested, thus benefiting the atmosphere.

AMORIM
AMORIM CORK COMPOSITES

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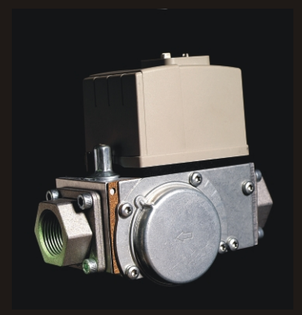
NATURAL GAS & LPG SEALING SOLUTIONS

TechSeal®



AMORIM
AMORIM CORK COMPOSITES

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TechSeal®

The Quality Seal

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TechSeal® IS THE NEW FAMILY OF PRODUCTS SPECIFICALLY DESIGNED AND TESTED FOR NATURAL GAS & LPG APPLICATIONS.

Techseal® products are designed to withstand the requirements of Natural Gas &LPG appliances, valves, devices or gas installations, while providing our customers with manufacturing options that will assure a reliable finished component or product.

QUICK REFERENCE GUIDE

Key requirements	TS1302	TS1028	TS7090	TS5500
Natural Gas	●	●	●	●
Liquid Petroleum Gas	●	●	●	●
High Temperature Resistance (ºC)	125	125	110	90
High Load Bearing	+++	++	+	+
Low Load Bearing	+	++	+++	+++
Certifications & Approvals				
NP4464[a]	√	√	√	√
UI157 [b]	√ [1]			
DIN 3535 part 5 [c]		√ [2]		
JIA C001 [d]			√	
EN 30.1.1, part 6.1.1.2 [e]	√	√		

● Suitable √ Complies

[1] UL listed Nº JMST2.MH2117
[2] DVGW Certificate Nº NG-5121BQ0521

[a] Cork/Rubber materials for tightness joints used in gas appliances, valves, devices and gas installation
[b] Gaskets and Seals, requirements cover test procedures and performance criteria for the evaluation of nonmetallic gasket and seal materials for specific end products.
[c] Rubber/Cork and rubber/cork synthetic fiber based gasket materials for use with gas valves, gas appliances and gas pipe work.
[d] Japanese gas appliance inspection association
[e] Domestic Cooking Appliances Burning Gas, Durability of Sealing Materials

CHARACTERISTICS AND ADVANTAGES

- TOLERANCE TO EXTREME SURFACE FINISHING CONDITIONS, SUCH AS "AS CAST".
- CONFORMABLE TO FLANGES WITH HIGHER "OUT-OF-FLATNESS" VALUES, SUCH AS STAMPED STEEL AND PLASTIC COVERS.
- LOWER BOLT TORQUES POSSIBLE
- FEWER FASTENERS IN THE SYSTEM
- SMALLER OR LOWER GRADE FASTENERS.
- ALLOWS FOR COMPONENTS WITH LESS MASS AND MORE DISTORTION.
- EASY TO FABRICATE.
- GOOD CHEMICAL COMPABILITY WITH BURNING GASES WITH VERY LOW GAS PERMEABILITY
- VERY LOW SIDE-FLOW IMPROVING CRUSH-OUT RESISTANCE.

For recommended service conditions regarding gasket average loading and continuous working temperature please refer to our **Material Datasheets**.

Check our **"Q-Tool"** sealing software on our website for a quick and comprehensive calculation of your joint system, or contact us for additional help to define our best material solution for your sealing requirement.

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SEALING MATERIALS FOR NATURAL GAS & LPG APPLICATIONS

A complete solution in one package

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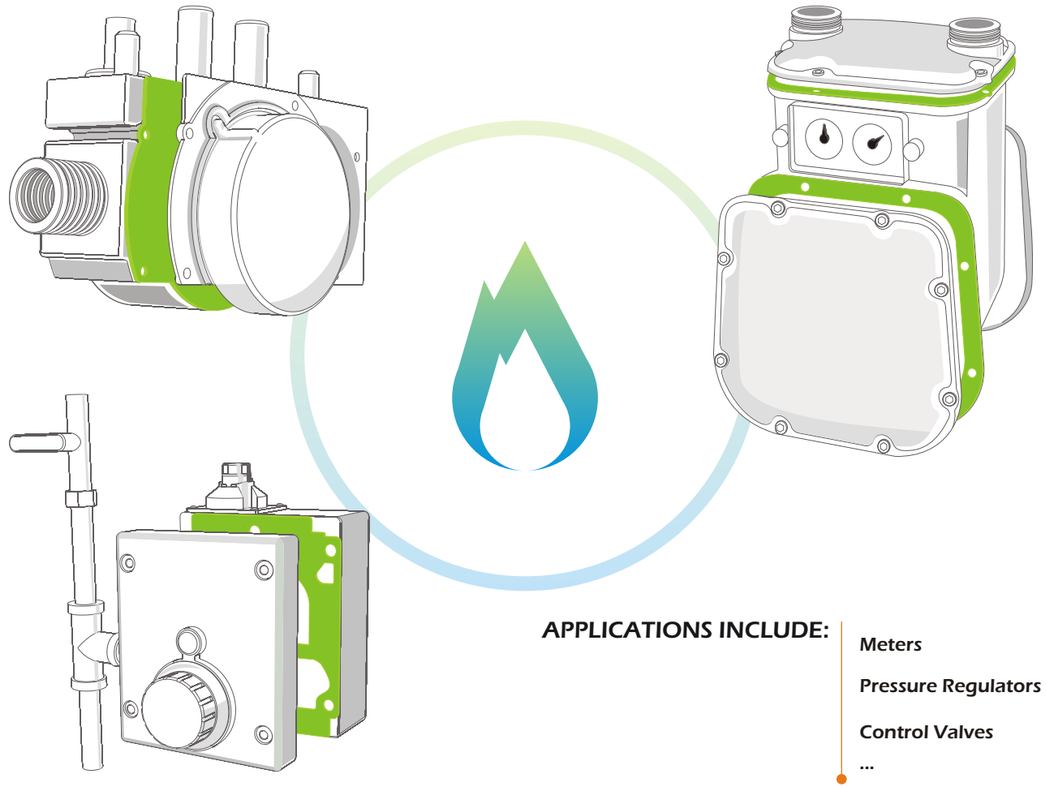
TECHNOLOGY THAT PAYS

Amorim Cork Composites products and engineering capabilities can provide you with a global advantage when it comes to designing your sealing system. Our systems approach offers you an overall optimized sealing solution.

READY FOR THE FUTURE

The usage of cork (a natural, renewable raw material with an important role in CO_2 reduction) in our products also contributes to the environmental sustainability approach of your business.



APPLICATIONS INCLUDE:

- Meters
- Pressure Regulators
- Control Valves
- ...

Several Amorim divisions are FSC (Forest Stewardship Council) certified. Recent studies in the Iberian Peninsula state that cork oak forest contributes with more than 20 Million tons of CO_2 retention, making it a significant world resource for the environmental balance.

Each time cork is harvested, cork bark regenerates itself. Cork oak trees store CO_2 in order to regenerate, and therefore a harvested cork oak tree absorbs 3 to 5 times more than one which is not harvested, thus benefiting the atmosphere.

AMORIM
AMORIM CORK COMPOSITES

TESTING & VALIDATION

TechSeal® products cover a wide range of applications in small gasoline engines.

Verification & Validation testing in industry reference engines, assure our customers a reliable cost effective, leak-free solution.

Excellent stabilized torque retention show that our materials are the best sealing solution for small gasoline engines.

TechSeal® products provide an average gasket loading from 2 MPa (290 psi) up to 30 MPa (4300 psi) and a compressive strength under the bolt head that exceeds 70 MPa (10000 psi).

Our products need a lower load to seal value in the system (when compared to medium density fiber materials).

They present excellent out-of-flatness tolerance eliminating the need for high cost silicone screen printed gaskets, or machined surfaces.

TechSeal® standard materials withstand up to 135ºC (275ºF) which means that they will comfortably meet the range of operating temperatures for soft gaskets in the engine.

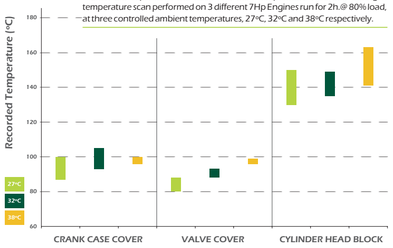
Premium grades are available for high temperature applications and fuel media contact.

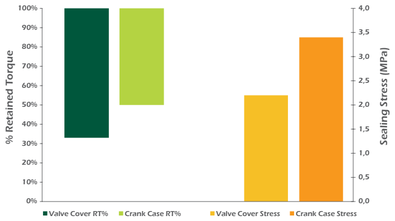
ENVIRONMENTAL CONTRIBUTION

Gasoline engines used in both handheld and non-handheld equipment are under pressure to comply with new evaporative emission standards. Cost effective and reliable sealing solutions are needed to help you comply with these new requirements.

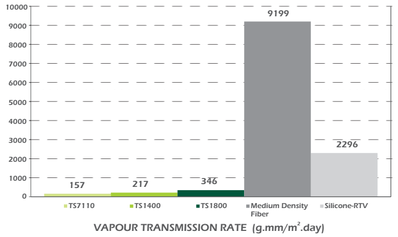
TechSeal® products present lower gasoline vapor transmission rates when compared with other sealing materials in the market (fibers and silicone RTV).

Each bar represents the max. and min. temperature recorded during a temperature scan performed on 3 different 7Hp Engines run for 2h.@ 80% load, at three controlled ambient temperatures, 27ºC, 32ºC and 38ºC respectively.





SMALL GASOLINE ENGINES RUN 100h @ 80% LOAD



VAPOUR TRANSMISSION RATE (g.mm/m².day)

ASTM D814 Standard Test Method for Rubber Property - Vapour Transmission of Volatile Liquids.

TechSeal® materials are a global performance sealing solution for Small Gasoline Engines.

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ACC January'08

SMALL ENGINE SOLUTIONS

TechSeal®

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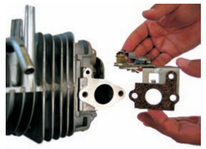
TechSeal® IS THE NEW FAMILY OF PRODUCTS SPECIFICALLY DESIGNED AND TESTED FOR THE SMALL GASOLINE ENGINE MARKET.

TechSeal® products are designed to withstand the application requirements of small engines, while providing our customers with manufacturing options that will assure a reliable finished component or engine.

Our product range will meet the application environment where contact with engine oil, unleaded gasoline or ethanol blends are required.

TechSeal® products are specifically designed for high distortion applications when stamped steel and plastic covers are to be used.

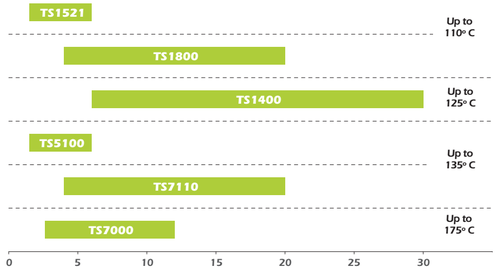


MATERIAL PROPERTIES

	TS1400	TS1800	TS7110	TS7000[a]	TS5100[a]	TS1521[a]
Density (kg/m³) [1]	1100	950	1100	1100	740	650
Hardness (Shore A)[2]	75	75	75	70	60	60
Tensile Strength (MPa) [3]	6,0	3,0	4,5	3,0	1,5	1,5
Elongation (%) [3]	30	60	35	100	30	20

(1) ASTM D297
(2) ASTM D2240
(3) ASTM D412, Die C
(a) not recommended for fuel contact

RECOMMENDED SERVICE CONDITIONS



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- EASY TO FABRICATE.

Recommended service conditions regarding gasket average loading and continuous working temperature pictured above.

Please refer to our **Material Datasheets** for detailed information.

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SEALING MATERIALS FOR SMALL GASOLINE ENGINES

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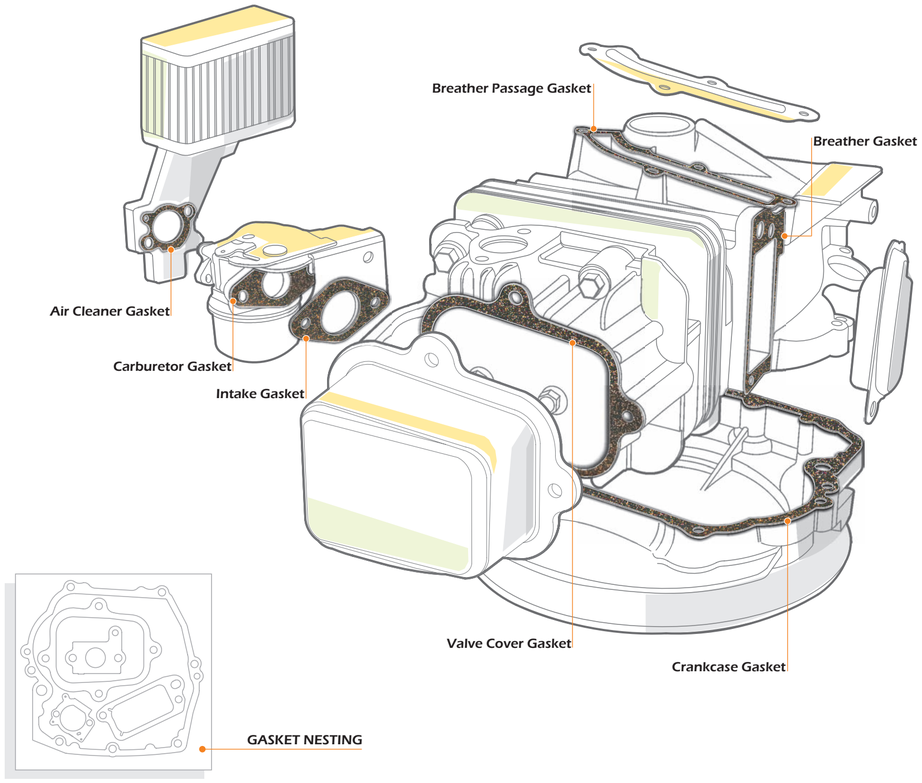
READY FOR THE FUTURE

Amorim Cork Composites products have been tested and are compatible with the new E85 ethanol fuel, as well as B100 bio-diesel fuel.

Our products have also been tested for gasoline permeability and can be used to reduce your evaporative emissions levels.

The usage of cork (a natural, renewable raw material with an important role in CO_2 reduction) in our products also contributes to the environmental sustainability approach of your business.

APPLICATIONS INCLUDE:



FLEXIBLE & EFFECTIVE SOLUTIONS

- MATERIAL CHARACTERISTICS ALLOWS FOR SINGLE THICKNESS AND NESTING SOLUTIONS
- ADHESIVE BACKING FOR FAST ASSEMBLY IS OPTIONAL
- MATERIALS ARE SUPPLIED IN ROLLS FOR QUICK SET-UP IN YOUR OPERATION, WITH THICKNESS RANGING FROM 0,5 mm (0.020 in) UP TO 3,2 mm (0.125 in)
- STANDARD ROLL WIDTHS OF 40 in AND REELS WITH DIFFERENT WIDTHS ARE AVAILABLE.
- ROLL LENGTHS CAN BE CUSTOMIZED TO MEET YOUR PRODUCTION SET-UP.
- SHEETS AND OTHER THICKNESS ARE AVAILABLE UPON REQUEST.

Several Amorim divisions are FSC (Forest Stewardship Council) certified. Recent studies in the Iberian Peninsula state that cork oak forest contributes with more than 20 Million tons of CO_2 retention, making it a significant world resource for the environmental balance.

Each time cork is harvested, cork bark regenerates itself. Cork oak trees store CO_2 in order to regenerate, and therefore a harvested cork oak tree absorbs 3 to 5 times more than one which is not harvested, thus benefiting the atmosphere.

AMORIM
AMORIM CORK COMPOSITES

Amorim T&D
for Transformers & Accessories

Amorim Cork Composites in the last four decades has been manufacturing and supplying materials and gaskets to the transformer industry. We've greatly increased our customer base around the world and proved to the industry that Amorim materials mean quality and reliability.

Amorim T&D IS THE NEW FAMILY OF PRODUCTS SPECIFICALLY DESIGNED AND TESTED FOR THE TRANSMISSION AND DISTRIBUTION MARKET.

In the global business era, we've prepared ourselves to be a world-wide player, efficiently delivering products through our distribution network. Our product portfolio includes:

QUICK REFERENCE GUIDE

SEALING

	TD1310	TD1120	TD1049	TD3510	TD7000	TD7110[a]
Density (kg/m³) [1]	1040	850	950	1000	1100	1100
Tensile Strength (MPa) [2]	2,5	2,0	3,0	2,5	3,0	4,5
Hardness (Shore A) [3]	70	65	75	65	70	75
Key requirements						
Low temperature resistance (°C)	-50	-40	-30	-60	-60	-35
High temperature resistance (°C)	110	125	125	130	175	135
Mineral Oil	●	●	●		●	●
Silicone Oil	●	●	●			●
Ester Oil	●	●	●		●	●
SF6 Gas	■	■	■	●		

(1) ASTM D297
(2) ASTM D412, Die C
(3) ASTM D2240

■ Acceptable
● Suitable

a) Vapor Drying Operation

VIBRATION

	VC2100	VC6400
Density (kg/m³) [1]	850	1000
Tensile Strength (MPa) [2]	2,0	2,5
Hardness (Shore A) [3]	65	70
Key requirements		
Creep Rate (%) [4]	2,0	1,4
Loss factor	0,19	0,25
High temperature resistance (°C)	125	125

(1) ASTM D297
(2) ASTM D412, Die C
(3) ASTM D2240
(4) ISO 8013

MOULDINGS

	VMQ	NBR	CR	EPDM	FKM	
Low Temperature Resistance	++	+		++		
High Temperature Resistance	++	+		+	++	
Oil Resistance		++	+		++	
Ozone Resistance			++	++		

Compounds with different hardnesses available.

Please refer to our **Material Datasheets** *for detailed information.*

Check our "**Q-Tool**" sealing software on our website for a quick and comprehensive calculation of your joint system, or contact us for additional help to define our best material solution for your sealing requirement.

Amorim T&D
MATERIAL TECHNOLOGY THAT WORKS
One Supplier - Multiple Solutions

Amorim Cork Composites provides technical support from material recommendations to deep involvement in application programs.

SEALING

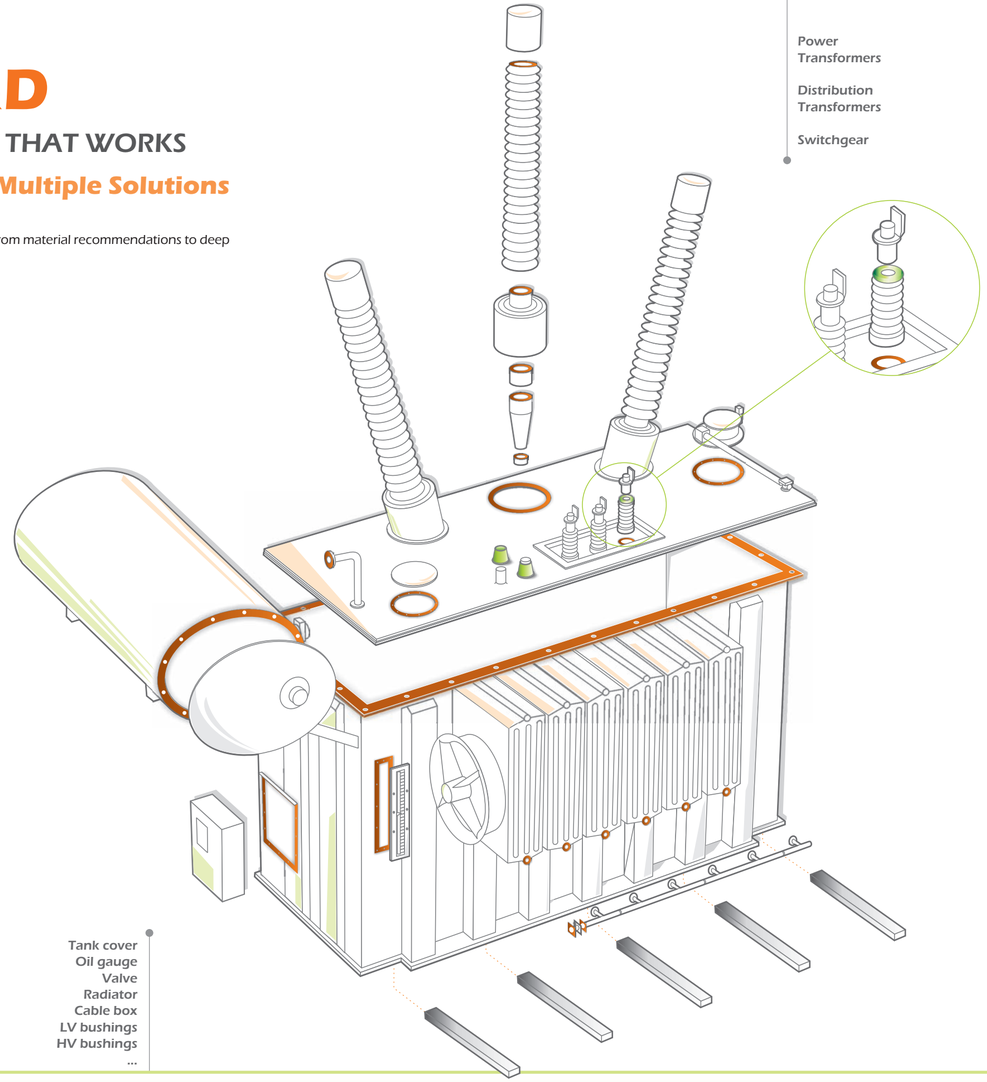
- Proven long term performance in the field
- Products with wide load range and suitable for extreme operation temperatures
- Tolerance to extreme surface finish conditions and high out-of-flatness flanges
- Experience in designing gaskets for multiple industries and applications

VIBRATION CONTROL

- Proven noise and vibration solutions working in major OEM's around the world
- Internal pads for distribution transformers
- External pads for power transformers
- Extensive product testing and application engineering support

RUBBER MOULDINGS

- Wide range of rubber compounds designed for use in the industry
- Certified formulations available
- Mouldings, extrusions and press-cut products
- Technical support and material testing facilities



FLEXIBLE & EFFECTIVE SOLUTIONS

- SEALING MATERIALS SUPPLIED IN ROLLS OR SHEETS, WITH THICKNESS RANGING FROM 1,0mm (0.040in) UP TO 12,0mm (0.472in).
- ROLL WIDTHS, FROM 1000mm (40in) UPWARDS AVAILABLE.
- REEL WIDTHS, FROM 40mm (1.6in) UPWARDS AVAILABLE.
- ADHESIVE BACKING OPTIONAL, FOR FAST ASSEMBLY.
- VIBRATION CONTROL MATERIALS SUPPLIED IN SHEETS OR PADS ACCORDING TO THE REQUIRED THICKNESS
- RUBBER MOULDINGS SUPPLIED ACCORDING TO INTERNATIONAL MANUFACTURING STANDARDS.

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AMORIM
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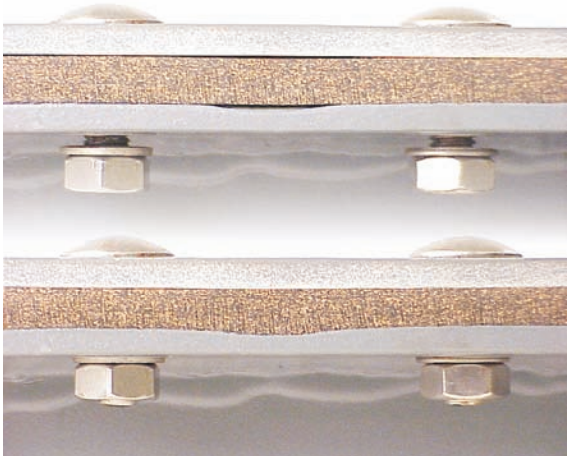
TESTING & VALIDATION

Amorim T&D sealing materials are unique because they compress mostly within themselves, showing less extrusion than rubber gaskets.

Flat gaskets will assure that you will have enough contact area, reducing the risk of misassembled gaskets (off-centre). They will also guarantee that you always get enough compression even when surface imperfections in the flange exist (distortion, paint or welding defects, etc).

Flat gaskets eliminate the need for controlled compression system designs, therefore cutting your manufacturing costs (materials and labour).

Most flanges will also present some "bow" when placed under load. Gasket conformability is critical is such conditions, and Amorim T&D material will provide a leak-free solution.

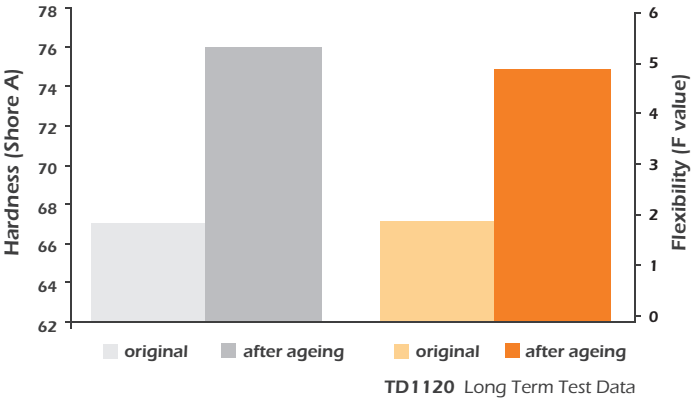


TD1049 Conformability to extreme flange conditions

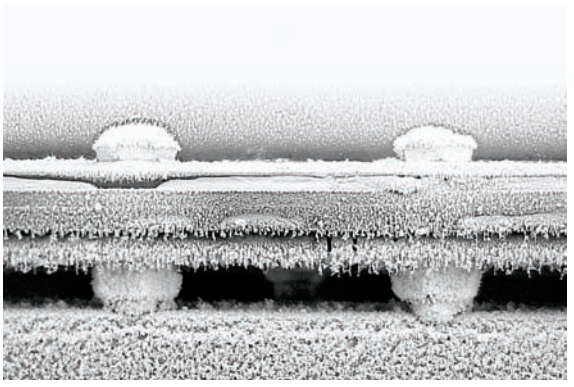
Amorim T&D materials were submitted to very severe ageing cycles (over 1500 hours @ 167ºC under compression and in full contact with oil) in order to show correlation with over 30 years of service life.

This test protocol, based on similar industry long term validation tests, confirms that Amorim T&D materials withstand transformer service life requirements and are suitable for service conditions of 125ºC or higher (up to 175ºC).

Application testing to reproduce extreme field temperatures like arctic conditions, with thermal cycles down to -60ºC, show that Amorim T&D materials remain flexible and retain the right amount of sealing stress in those conditions.



TD1120 Long Term Test Data



TD1310 under arctic conditions

Amorim T&D - Material Technology ready for the future

Amorim T&D

TRANSMISSION AND DISTRIBUTION VIBRATION CONTROL

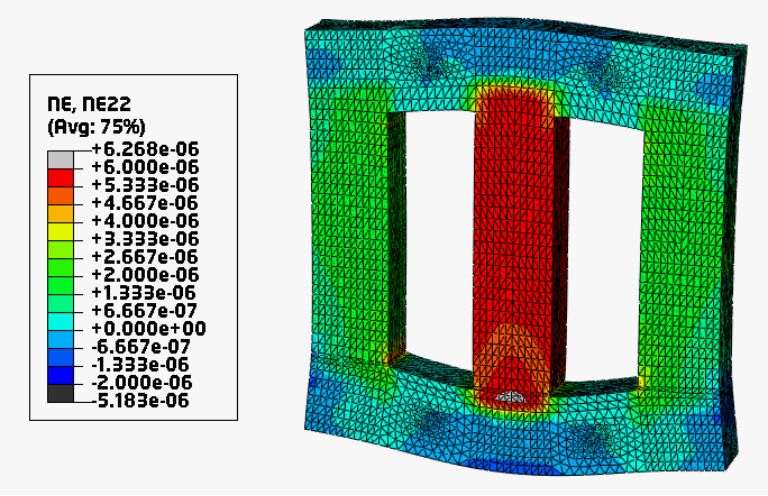
JANUARY, 2010

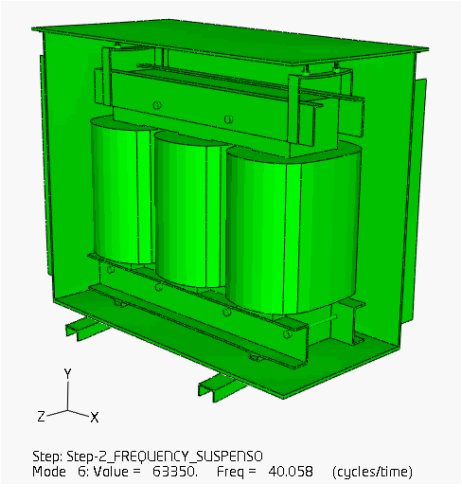
AMORIM

AMORIM CORK COMPOSITES

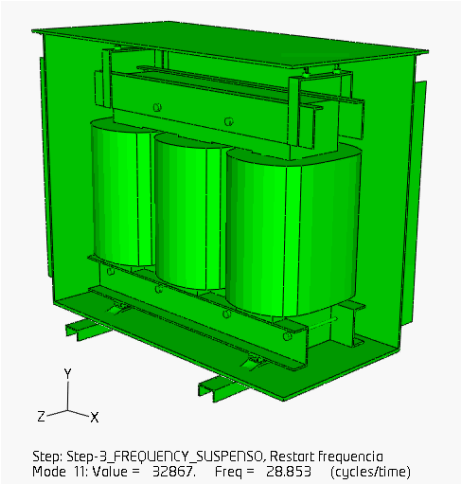
TRANSFORMER NOISE
Sources of Sound

Transformer noise is a *hum* characterized by spectral spikes at harmonics of the fundamental frequency witch is twice the line supply of the electrical frequency (50Hz/60Hz). Transformer's **low frequency tonal** noise components are the major source of annoyance. Other sources of noise, such as the cooling fans and the pumps, are considered to be negligible contributors to the far-field noise.





WITHOUT



WITH

TRANSFORMER NOISE

Core vibration caused by **Magnetostriction of core material**

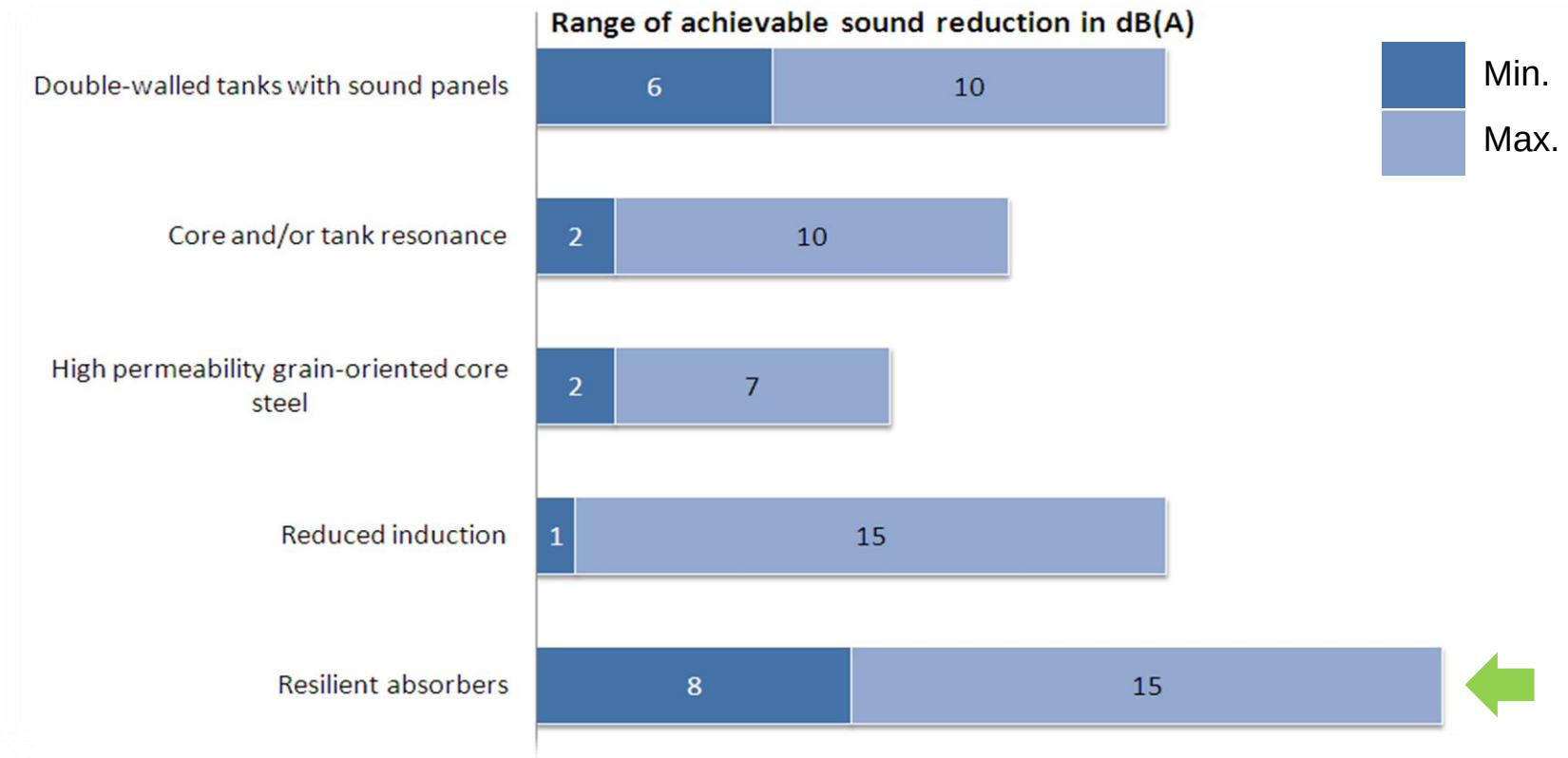
- 120, 240 and 360 Hz with some 480 Hz for 60 Hz operation
- 100, 200, 300 and 400 Hz for 50 Hz operation

Cooling Equipment Noise – caused by **Fans and Pumps**

- Fan blade or Motor noise : low –frequency components < 100 Hz

An unexpected high level of a frequency component would indicate core / tank resonance.

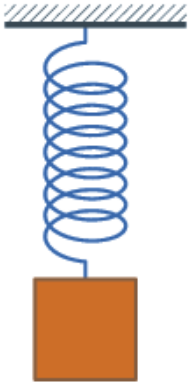
Transformer Noise Abatement Tecnhiques



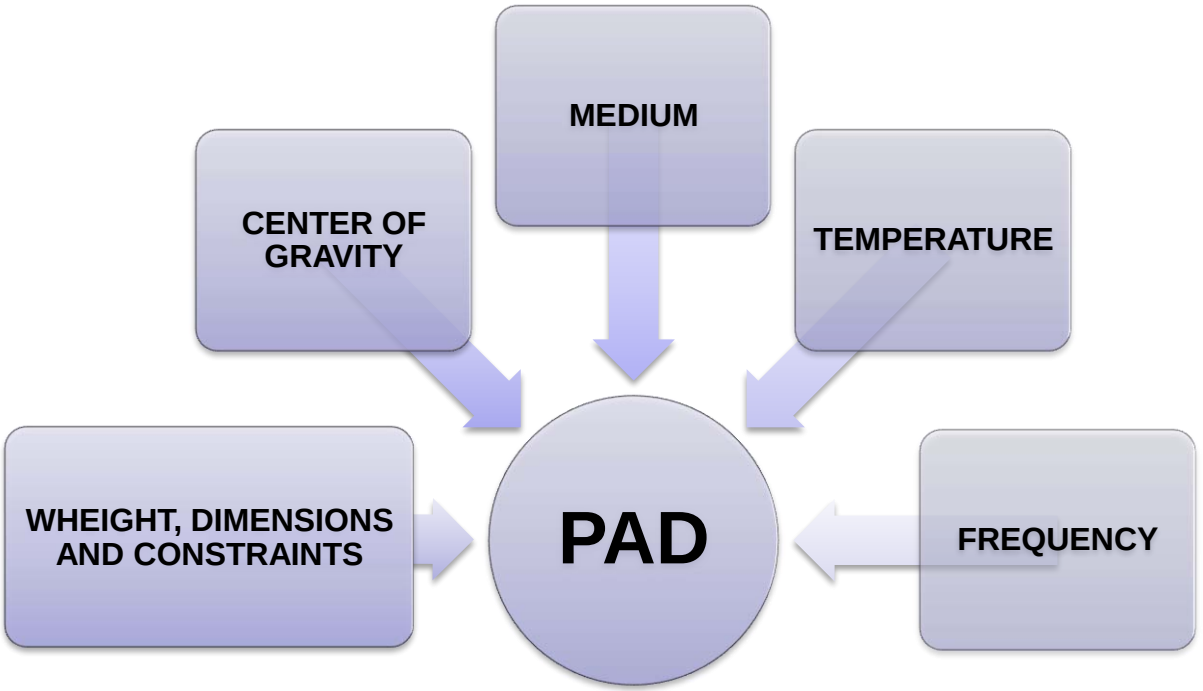
Source: IEEE Std C57.136-2000

VIBRATION PADS – DESIGN GUIDLINES

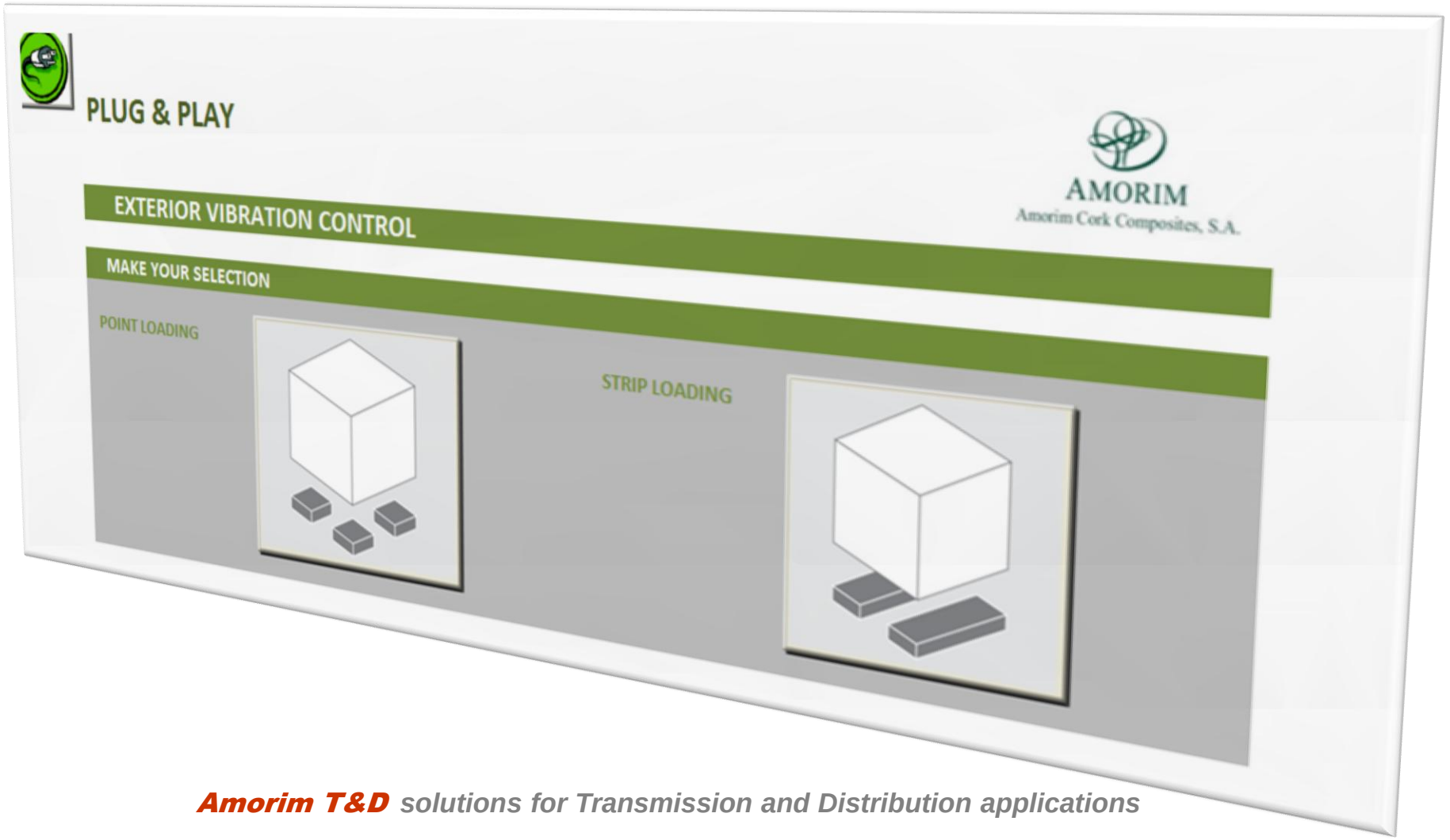
VIBRATION ISOLATION



NOISE REDUCTION

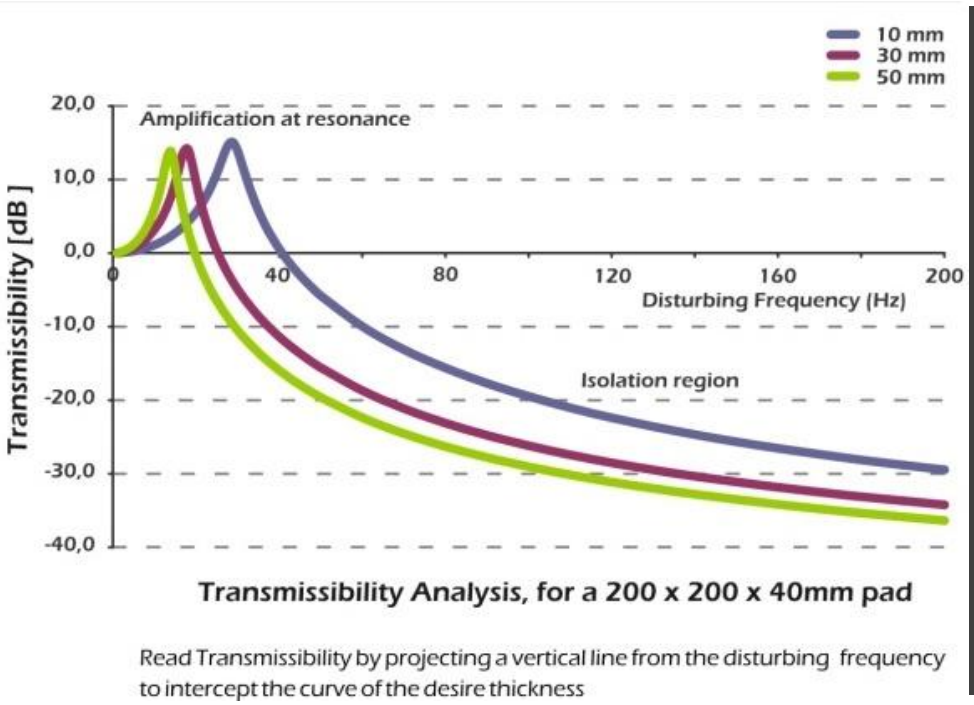


OUR SOLUTION – Use our PLUG & PLAY Calculation Tool



VIBRATION PADS – TRANSMISSIBILITY CURVE

Transmissibility, TR, provides a common measure of Vibration Control performance, and can be expressed in linear units or logarithmically, for example, in decibels (dB).



Transmissibility Analysis, for a 200 x 200 x 40mm pad

Read Transmissibility by projecting a vertical line from the disturbing frequency to intercept the curve of the desire thickness

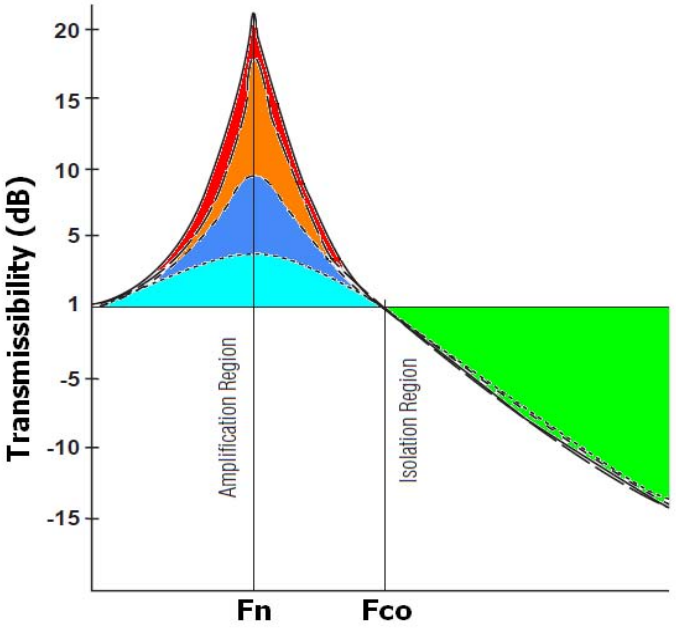
Briefly, transmissibility is a measure of the vibration response of a system divided by the magnitude of the vibration input to the system.

- Lower transmissibility implies greater isolation.
- Increasing the pad thickness (maintaining the geometry) decreases the natural frequency, and hence increasing the isolation region.

VIBRATION PADS – TRANSMISSIBILITY

Isolation vs. Dampening

Amorim Vibration Control Materials exhibit high material loss factors resulting in **low amplification at resonance**, giving them operational effectiveness over a **broad range of frequencies**.



The amount of damping in the isolation system will determine the magnitude of peak transmissibility (Fn) for the system. As damping increases, this peak value will decrease.

A vibration isolator lowers the natural frequency of a system to below the excitation (or disturbing) frequency, keeping these two frequencies greatly apart reduces or isolates vibration.

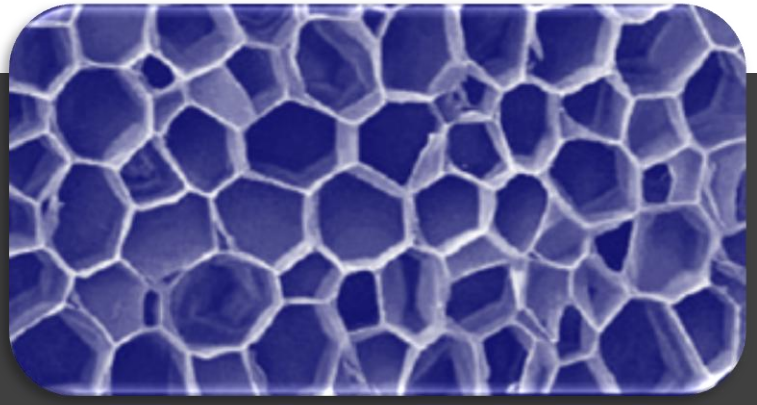
Note: Properly designed metal springs and rubber mounts can be good isolators but have almost no damping capability.

VIBRATION PADS – TRANSMISSIBILITY

Material Loss Factor

The loss factor of a material represents the ratio of energy it dissipates to the amount it stores, temporarily for each cycle of vibration. Energy dissipation is achieved through the conversion into heat.

Our specific polymer formulations and the inclusion of CORK, due to it's unique compressibility and recovery characteristics, absorb energy, yielding high material loss factors.



Cork cells are minute, irregular pentagonal or hexagonal prisms. The cell height rarely exceeds 50 micrometers. Fifty per cent of cork is an air-like gas enclosed in the cork cells. **Suberin** makes the **cork cell membrane impermeable and the cell airtight.**

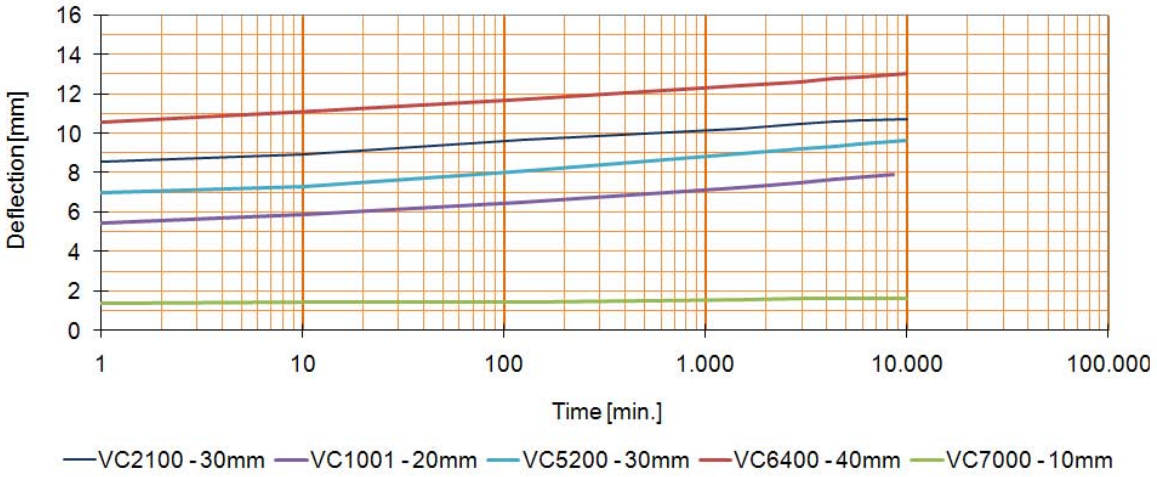
TRANSFORMER VIBRATION CONTROL MATERIALS

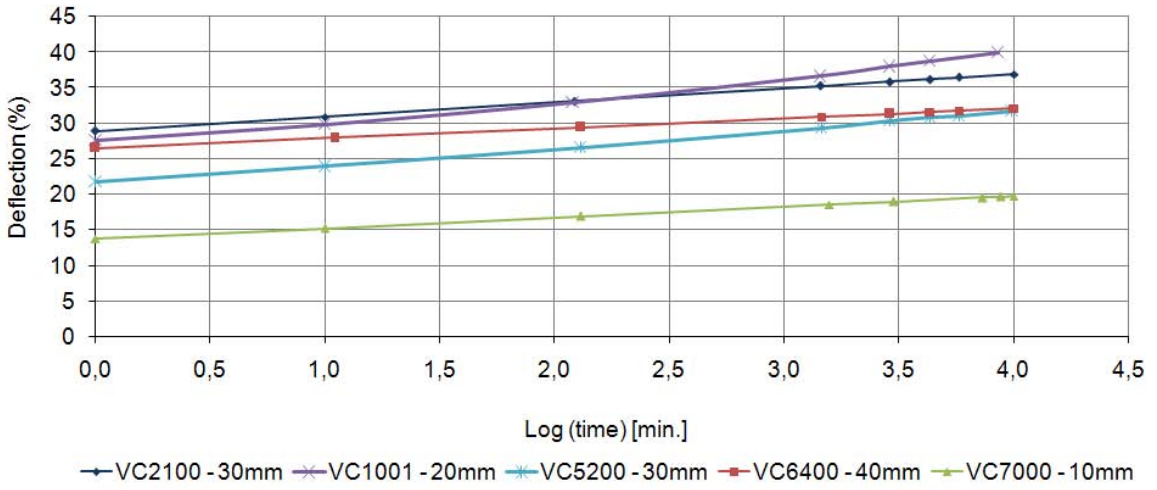
	VC 2100	VC1001	VC5200	VC 6400	VC 7000
Maximum Load	2,0 MPa (290 psi)	0,25 MPa (36 psi)	0,6 MPa (87 psi)	2,0 MPa (290 psi)	10,0 MPa (1450 psi)
Work Load Range	0,5 - 1,5 MPa (72 - 217 psi)	0,05 - 0,2 MPa (7 - 29 psi)	0,2 - 0,5 MPa (29 - 72 psi)	0,5 - 1,5 MPa (72 - 217 psi)	1,0 - 6,0 MPa (145 - 870 psi)
Temperature Range	-40ºC to 125 ºC (-40ºF to 257ºF)	-40ºC to 90 ºC (-40ºF to 194ºF)	-40ºC to 110 ºC (-40ºF to 230ºF)	-30ºC to 110 ºC (-22ºF to 230ºF)	-60ºC to 175 ºC (-76ºF to 347ºF)
Density (kg/m^3)[1]	850	500	700	1000	1100
Hardness (Shore A)[2]	65	25	60	70	70
Tensile Strength (MPa)[3]	2,0	0,3	1,2	2,5	3,0
Creep Rate (%)[4]	2,0	3.0	2,5	1,4	1,5
Loss Factor	0,19	0,21	0,21	0,20	0,05
Application	**Internal Vibration Control** (Oil Contact)	**External Vibration Control**	**External Vibration Control**	**External Vibration Control**	**Internal Vibration Control** Dry Transformers
			MOST USED	MOST USED	

(1) ASTM D297
(2) ASTM D412, Die C
(3) ASTM D2240
(4) ISO 8013

VIBRATION PADS – DESIGN FOR LIFE

CREEP or DRIFT





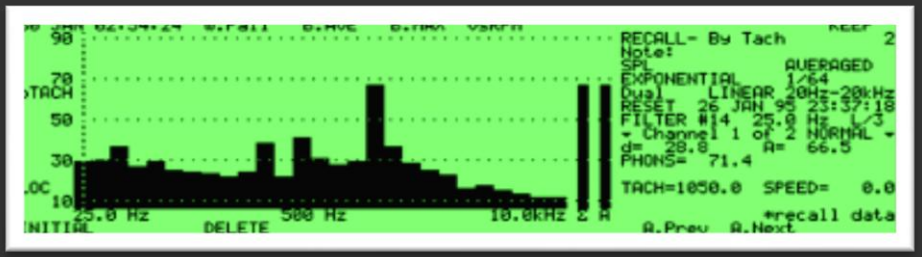
Creep is a Log decrement phenomenon, this means that the amount of deflection varies linearly with the Log of time. The amount of deflection in 1 day is the same as that in 10 days, is the same as that in 100 days, etc. This deflection has to be accounted for in the design process.

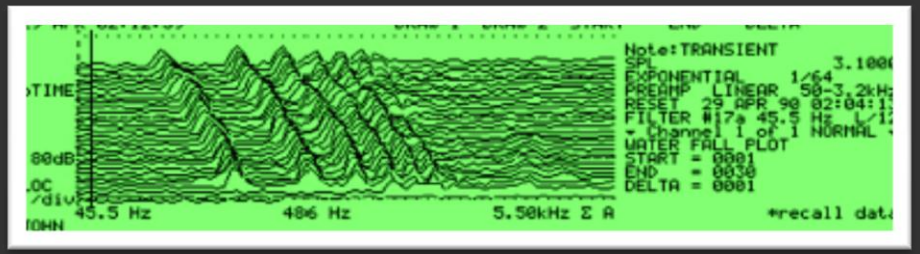
Amorim Vibration Control materials have been tested according to ISO8013 above their load working conditions, and even so show an excellent retention in height.

On Site Validations & Trouble Shooting

Portable sound instrument system:

- Sound level measurements in the field.
- Sound Intensity measurements in the field
- Reverberation measurements in the field
- Diagnostic tests to indicate weak links in the acoustic system.





Amorim T&D

CASE STUDIES

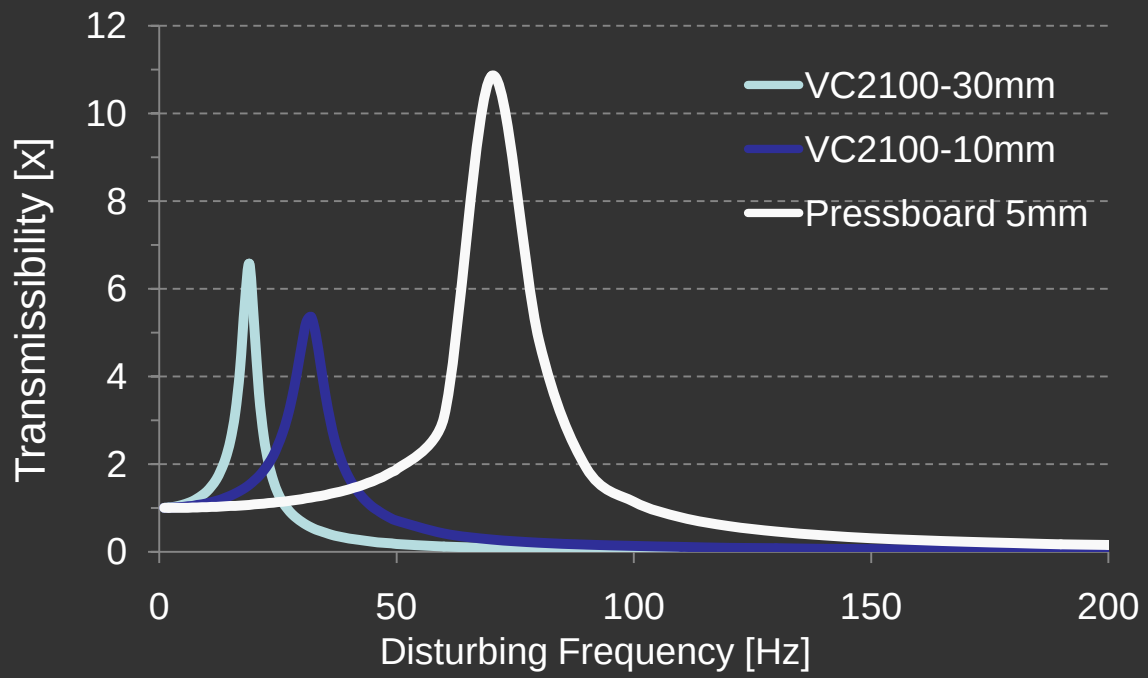
JANUARY, 2010

AMORIM

AMORIM CORK COMPOSITES

CASE I – Interior Control

VC2100 is used as an internal mat (or pad) replacing Pressboard



- Higher damping => lower amplification at resonance
- Higher isolation level starts to isolate well below pressboard (60/100 Hz versus 210 / 270 Hz)

CASE II – Exterior Control – VC6400 @ 40mm

VC6400 in Power Transformer (40MVA) External Pads

- **Current Noise Level - 62dBA**
- **Target Noise Reduction - 3dBA**

❑ Pad Dimensions: 900 mm x 200 mm x 40mm

❑ Weight: 32 tons

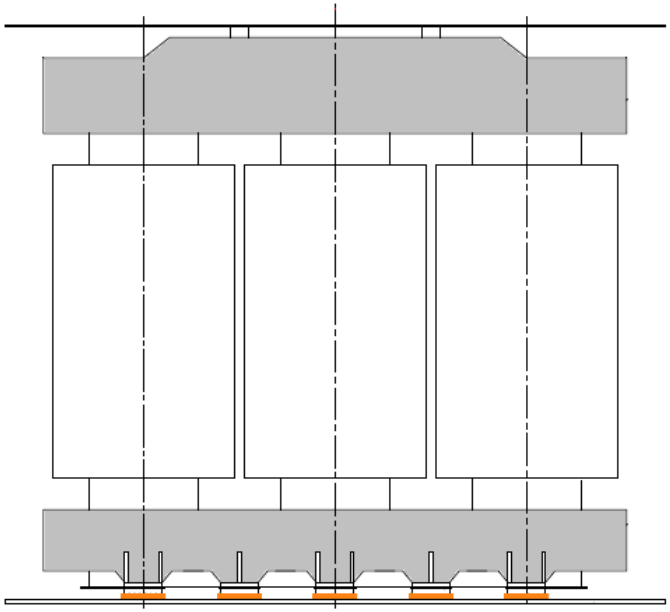
❑ Fluid: mineral oil

❑ Number of pads: 3

✓ Material = VC6400 (within load range)

✓ Transmissibility at 100 Hz (at 40mm) = -28dB

✓ Isolation = 96 %



VC6400 grade has been specifically formulated to perform in longevity in the application environment when subject to the application conditions, such as the presence of Ozone/UV (1)

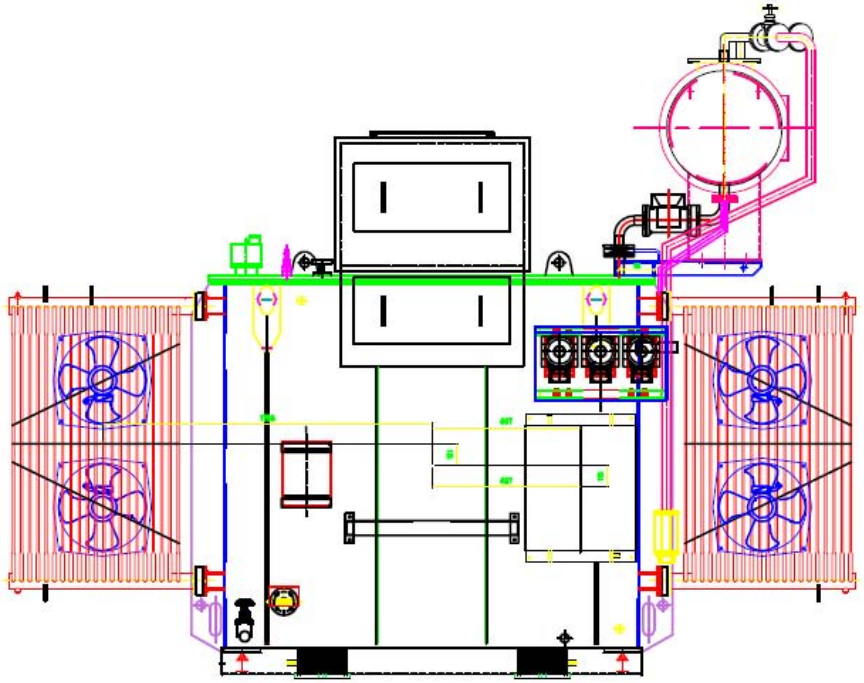
(1) Ozone gas is produced during electric discharge by sparking or corona discharge (or static electricity build up) for example. Ozone is also produced by the action of sunlight on volatile organic liquids (VOL's).

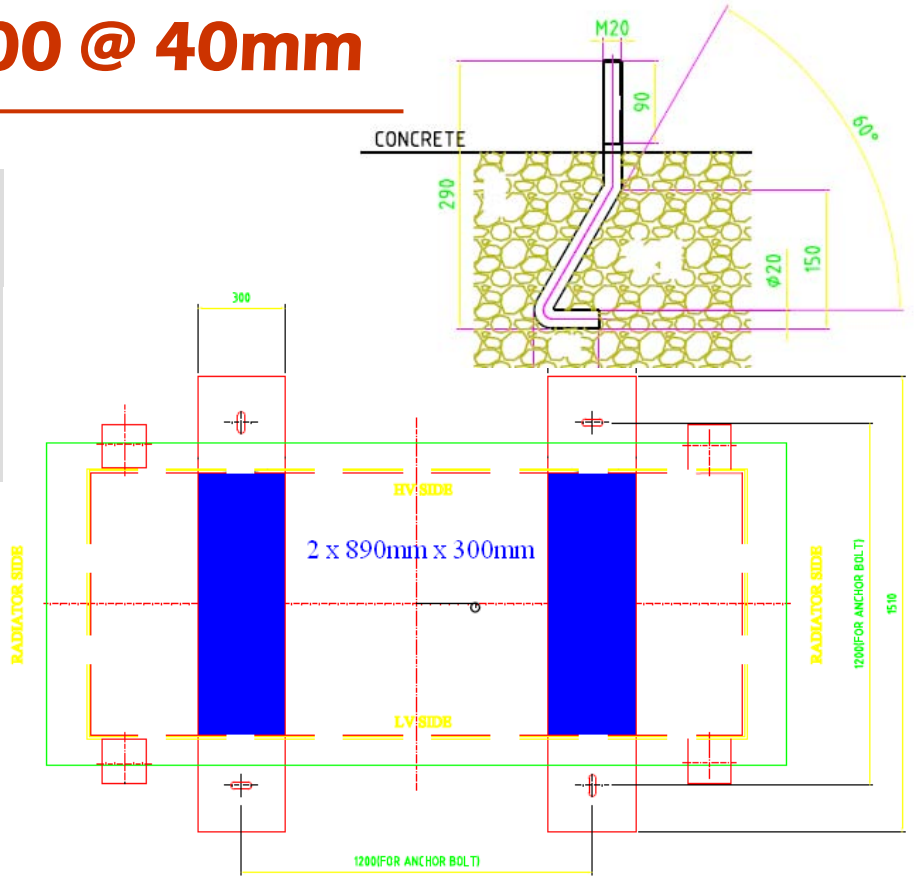
Noise measurements performed resulted in a decrease of -5 dBA in the result of using VC6400 Vibration Control Material

CASE III – Exterior Control – VC6400 @ 40mm

Power Transformer 20ton (8/10MVA) with anchor bolts

- ❑ Pad Dimensions: 890 mm x 300 mm x 40mm
- ❑ Weight: 20 tons + 4xM20 Anchor bolts (25% - 75% yield torque)
- ❑ Number of pads: 2





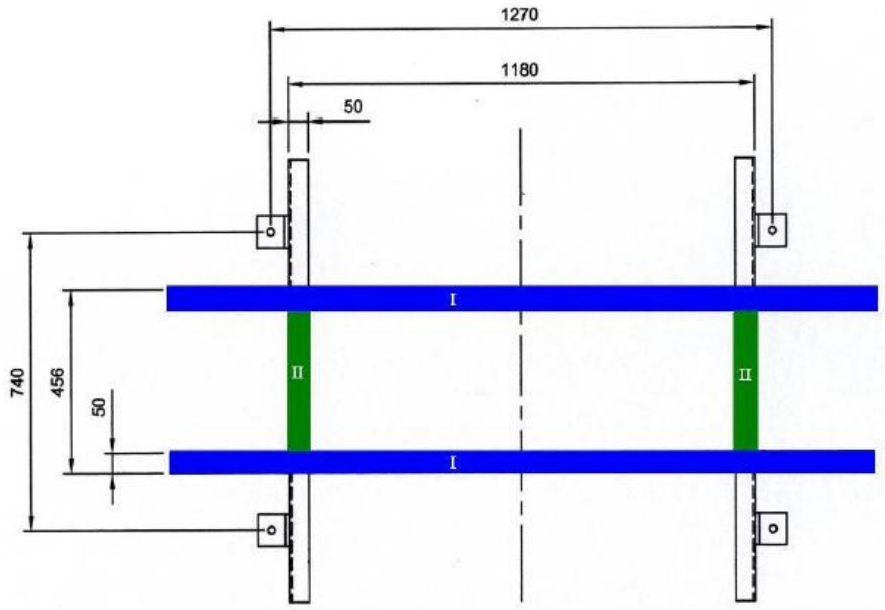
- ✓ **Stress= 0,66 – 1,25MPa**
- ✓ **Transmissibility at 100 Hz (at 40mm) = -28,4dB - 29,6dB**
- ✓ **Isolation = 96% - 97%**
- ✓ **Shape Factor = 2,8**

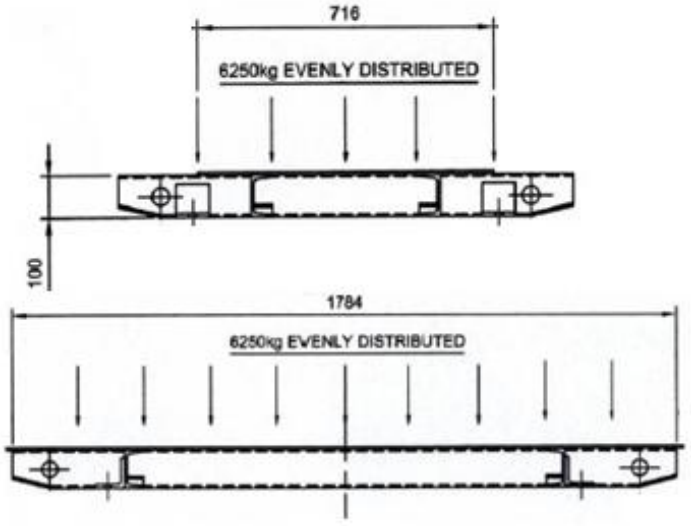
CASE IV – Exterior Control – VC5200 @ 30mm

Power Transformer 6,3ton (200kVA) with C-Profile foundation fixing

- ❑ Pad Dimensions:
  - i. 2 pads 1784 x 50 x 30mm. Each pad is a butt glued through two pieces 892 x 50 x 30mm
  - ii. 2 pads 356 x 50 x 30mm.
- ❑ Weight: 6,25ton
- ❑ Number of pads: 4

- ✓ **Stress= 0,29MPa**
- ✓ **Transmissibility at 100 Hz (at 30mm) = -26,4dB**
- ✓ **Isolation = 95%**
- ✓ **Shape Factor = 0,73 – 0,81**



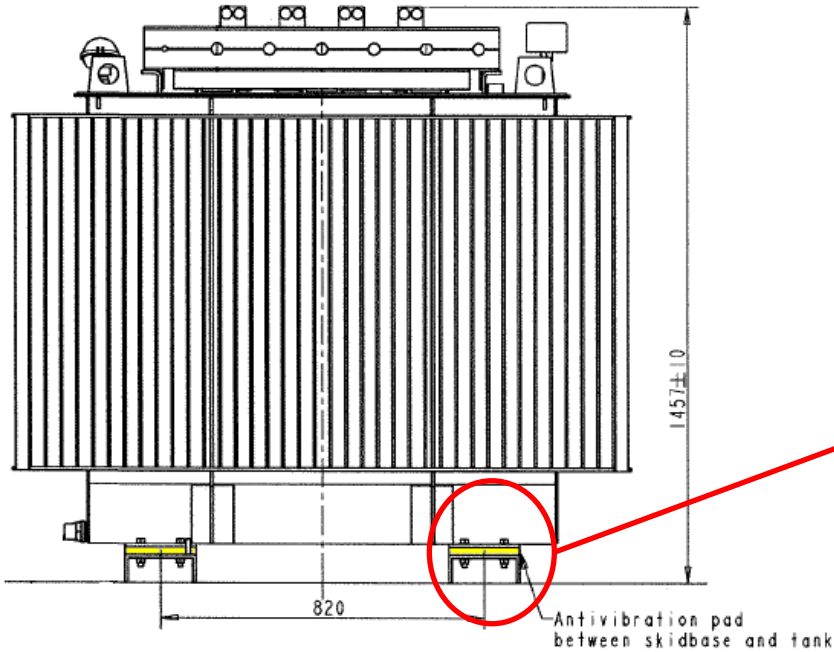


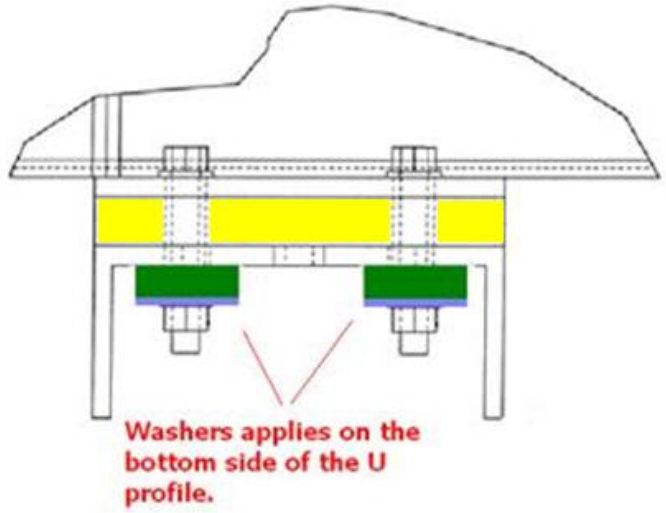
CASE V – Exterior Control – VC5200 @ 12,5mm

Wind Power Transformer 2,8ton (1000kVA) with U-Profile and anti vibration vibration collar

- ❑ Pad Dimensions: 480mm x 180mm x 12,5mm
- ❑ Weight: 2,8ton + 8xM16 bolts @ 30N.m torque
- ❑ Number of pads: 2
- ❑ Number of collars: 8

- ✓ **Stress= 0,16 – 0,4MPa**
- ✓ **Material = Pad - VC5200; Collars – VC6400**
- ✓ **Transmissibility at 100 Hz (at 12,5mm) = -22dB**
- ✓ **Isolation = 94%**





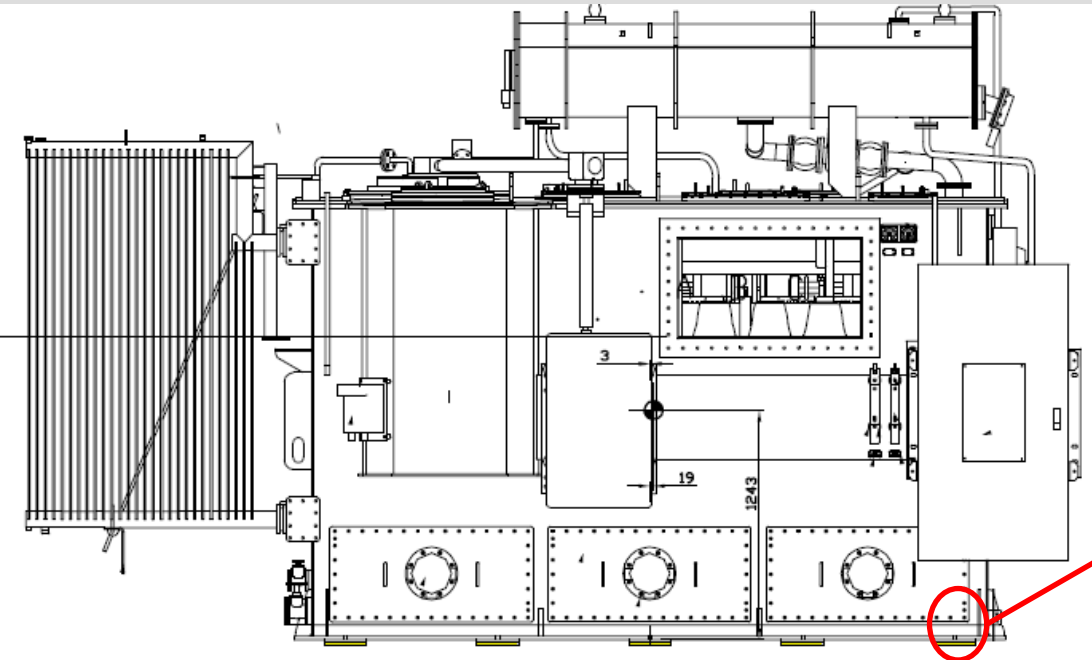
CASE VI – Exterior Control – VC6400 @ 40mm

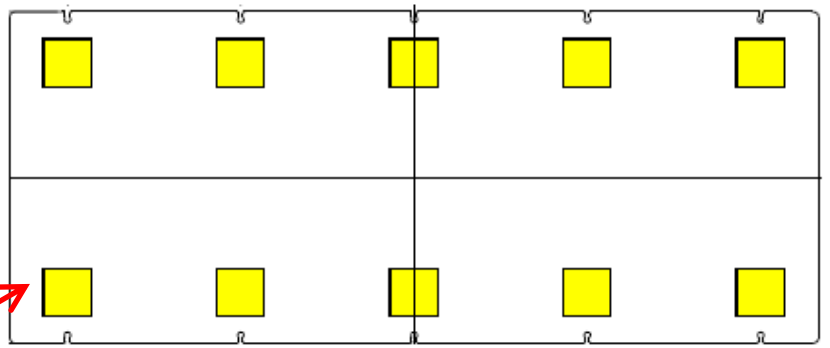
Power Transformer 32ton (10MVA) – Substitute profiled rubber pads

- ❑ Pad Dimensions: 230mm x 230mm x 40mm
- ❑ Weight: 32ton
- ❑ Number of pads: 10

Profiled rubber/metal pads

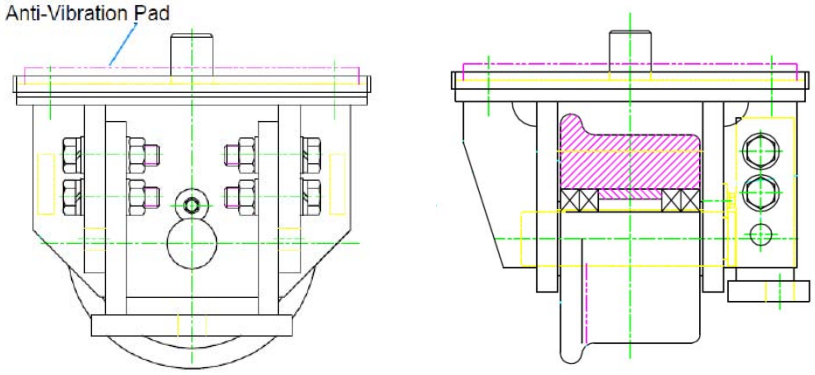
- ✓ **Stress= 0,6MPa**
- ✓ **Transmissibility at 100 Hz (at 40mm) = -30dB**
- ✓ **Isolation = 98%**
- ✓ **Shape Factor= 1,44**



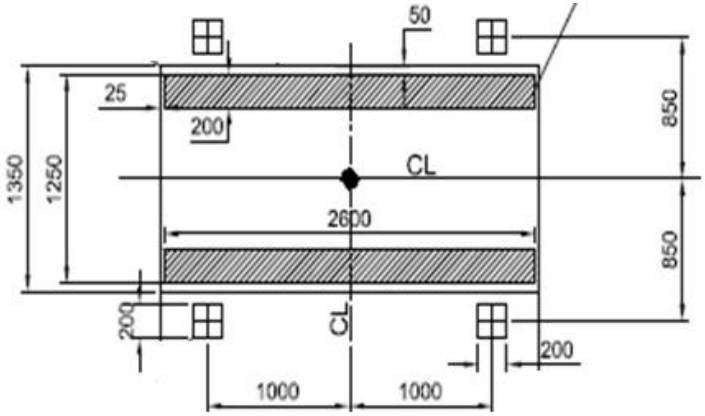


Skid Base w/ Pads

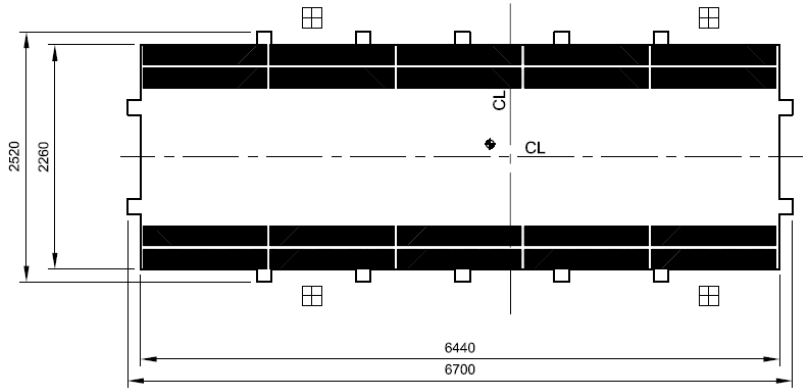
EXTERNAL PADS APPLICATIONS – Flexible Construction and Assembly



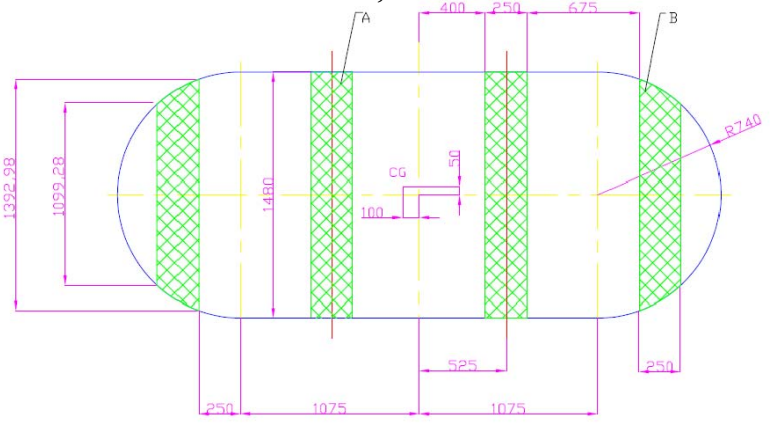
122ton Transformer wheel pads
Vibration attenuation : -32dB



Shunt Reactor
34ton, 30MVA

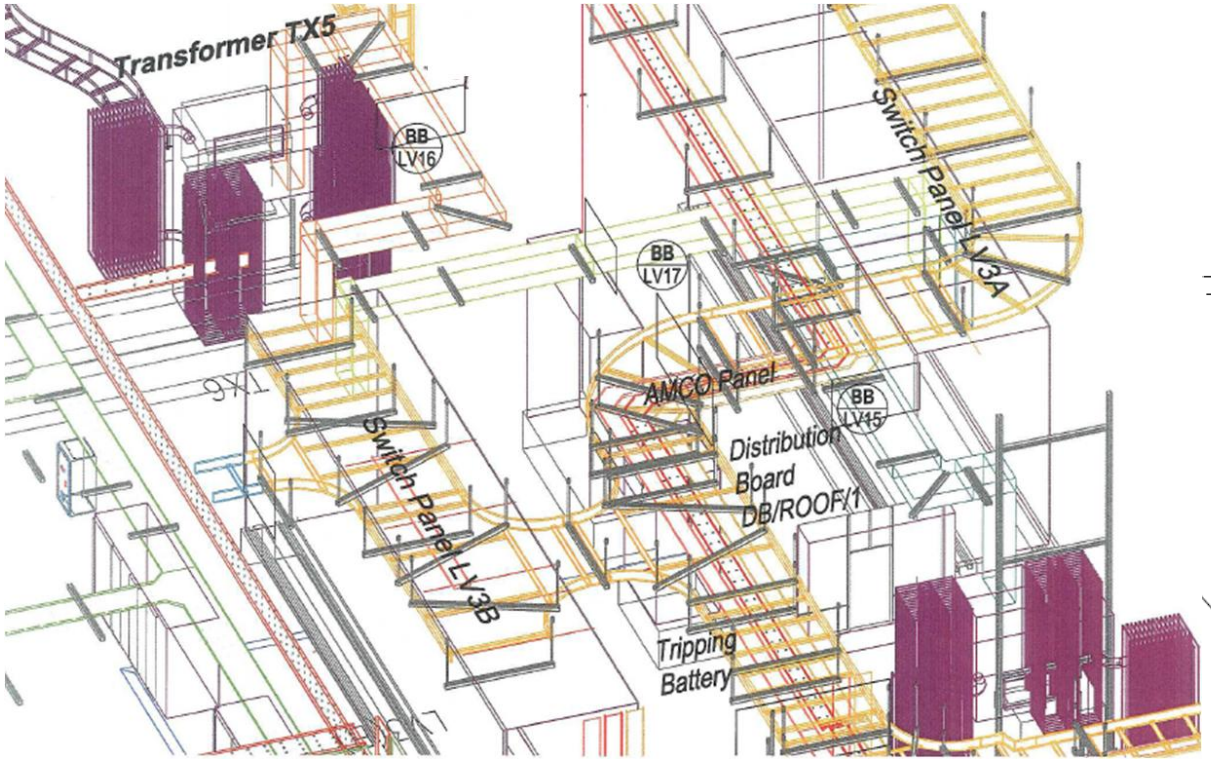


Shunt Reactor
235ton, 150 MVA

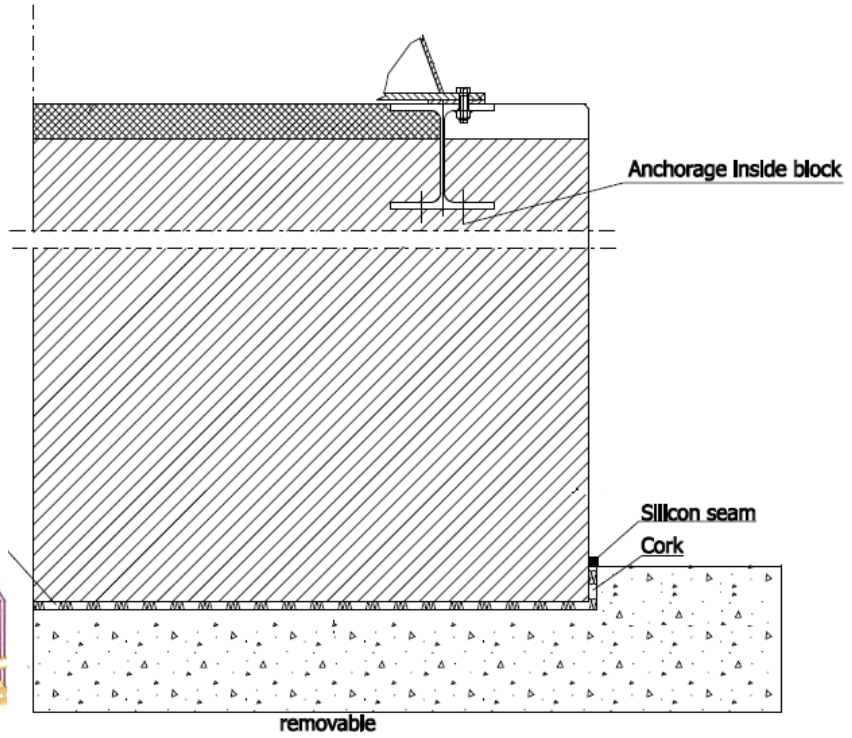


Transformer
51ton, 25MVA

EXTERNAL PADS APPLICATIONS – Flexible Construction and Assembly



Vibration attenuation on busbar supports for transformer cabling



On Site Substation Concrete Foundation for Transformers with Rotary Mass Motor

AMORIM

AMORIM CORK COMPOSITES

JANUARY, 2010