TT MOUNTS

general

The TT mounts are especially developed for the high powered / low weight, close coupled engine / gearbox combinations. The unique mounting design characteristics enables to transmit both Thrust and Torque forces whilst ensuring an excellent vibration isolation. The TT mounts have a linear stiffness over a wide load range varying from compression (–) to extension (+) necessary to maintain the optimum isolation properties of the Mass-Spring system formed by engine / gearbox and mounts. The close coupled gearbox reduces the engine rpm's and as a consequence, magnifies the engine torque. The reaction torque is being transferred over the TT mounts to the foundation as additional compression or extension forces which requires the TT mounts unique linear (compression / extension) stiffness to maintain the same high degree of isolation.

specification

The stiffness ration from Vertical (Z) to Longitudinal (X) is selected such to minimise displacements of the installation and connected equipment in this direction, which for instance is beneficial for shaftseals. The thrust capacity per mount, related to the actual mount load (FZ) can be taken from the capacity curves. The height adjustable TT mounts are produced in a light-weight, seawater resistant aluminium and among others feature slotted / threaded holes to secure the mounts during transportation and, or alignment of the engine installation. The castings are designed such as to protect the interchangeable rubber inserts from contamination. The central threaded stud enables easy installation and in the case of a thrust transferring application of the TT mounts, the recommended tightening torques should be kept. The TT mounts have an integrated limiter which limits the displacements in the vertical direction to +3.1 and –11.5 mm for the TT1 mount, +3.3 and –6.3 mm for the TT2 mount and +3.0 and –9.0 mm for the TT3 mount. In the horizontal direction the TT1 mount is limited to + or –5 mm, the TT2 mount to + or –3 mm and the TT3 mount to + or –4 mm.

The standard rubber mix NR39 is available from 45° Sh.A up to 70° Sh.A and can be used up to 90° C continuous and 110° C peak temperature, furthermore it will ensure low creep values. The NR 11 mix is available in 45° to 75° Sh.A, which can be used up to 70° C continuous and 90° C peak temperature and will ensure higher load capacities. All TT mounts are marked with the rubber hardness derived from the individual stiffness test on one side of the top casting.

selection

The mount selection for a Thrust and Torque transferring propulsion installation can generally be made according to the following guidelines and is based solely on mount loads. The selection made according to these guidelines will prevent overloading of the mounts.

1. Calculate the vertical (Z) static load per mount position.
2. Select mount type (1 or 2) and rubber mix, not exceeding initial static load limit in the appropriate load / deflection graph.
3. Calculate the additional torque forces (+ and –) in the full load situation per mount position.
4. Add the load per mount as found under 1 with the torque forces per mount as found under 3. Check the calculated maximum and minimum vertical load points on the initial chosen load deflection curves to be within the allowed deflection range.
5. Determine the maximum thrust loads from the appropriate graph, based on the maximum and minimum vertical load and rubber mix.
6. Determine the total horizontal (X) thrust load for the installation and check against the total maximum thrust load of all mounts together. Select a different rubber hardness if required.

The analysis of the natural- and disturbing frequencies of the mounting system should confirm the mount selection.

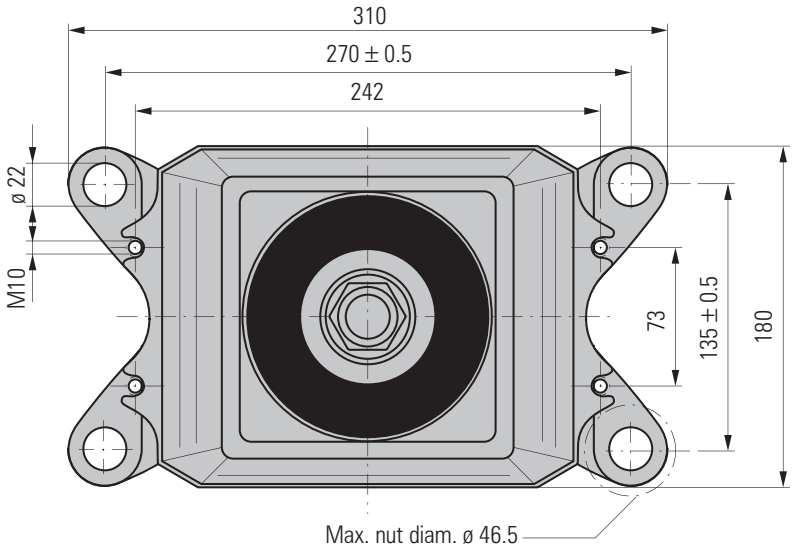
shockloads ▶

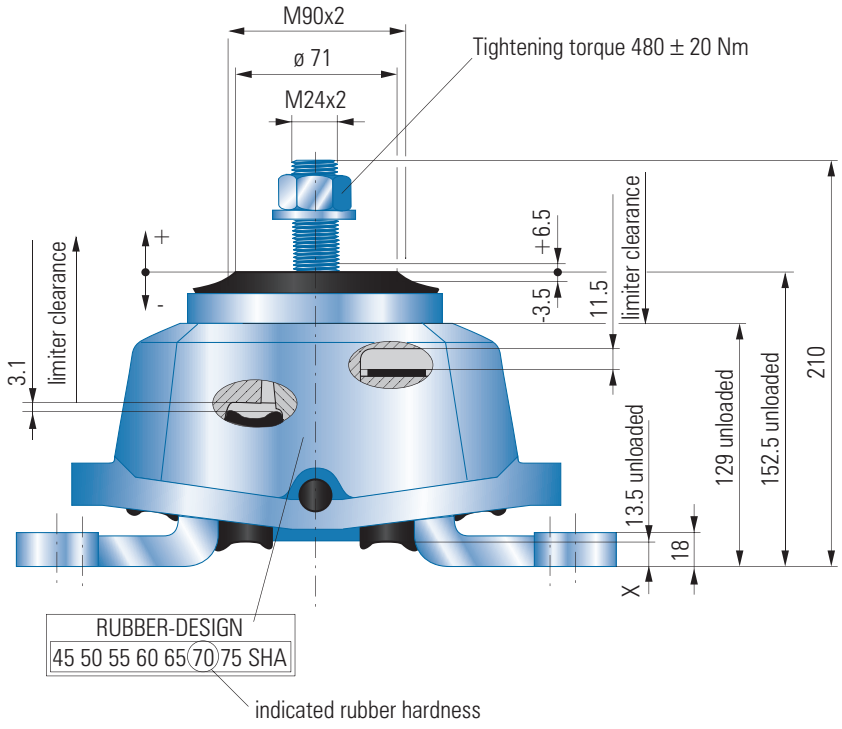
TYPE / DIRECTION	Fz+ (kN)	Fz– (kN)	Fy + or – (kN)	Fx + or – (kN)
TT1	75	200	60	85
TT2	25	200	20	50
TT3	50	200	40	65

DIMENSIONS

TT mount

type 1



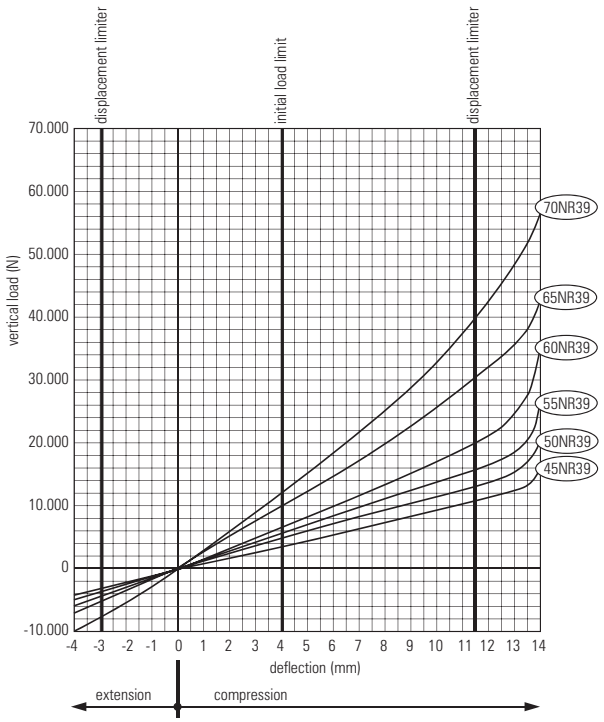


Patent registration nr. 1012075

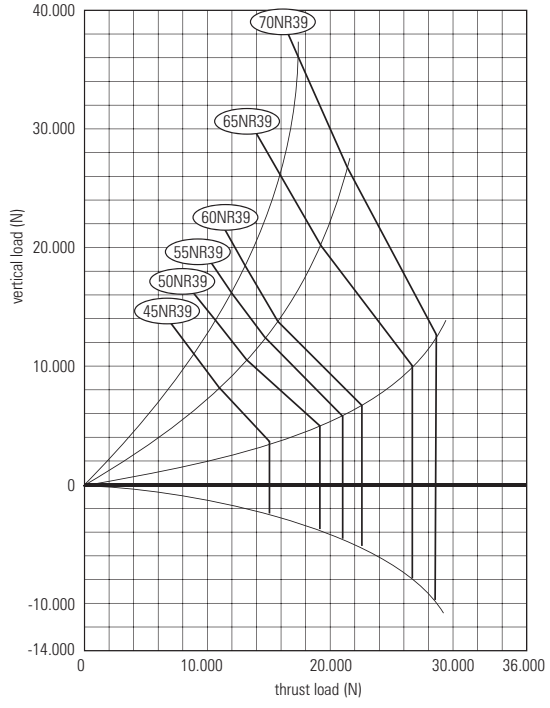
SELECTION CHART

TT mount

type 1



Load - Deflection Curve

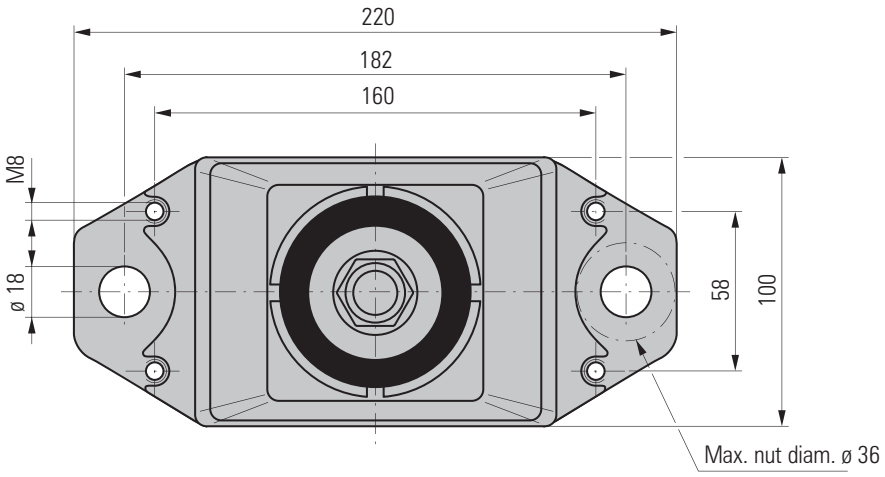


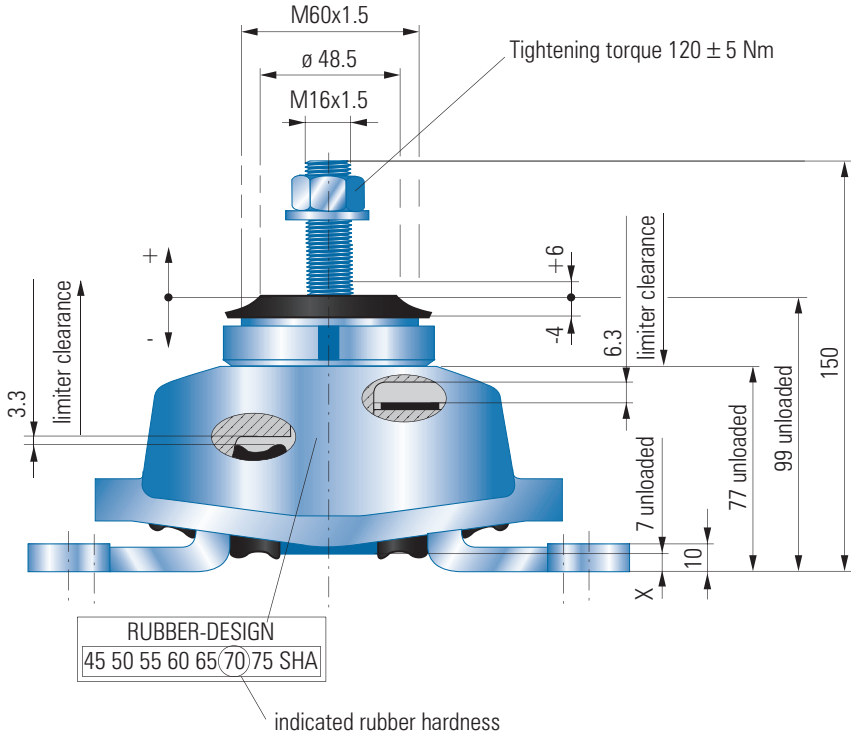
Thrust Load related to vertical load

DIMENSIONS

TT mount

type 2





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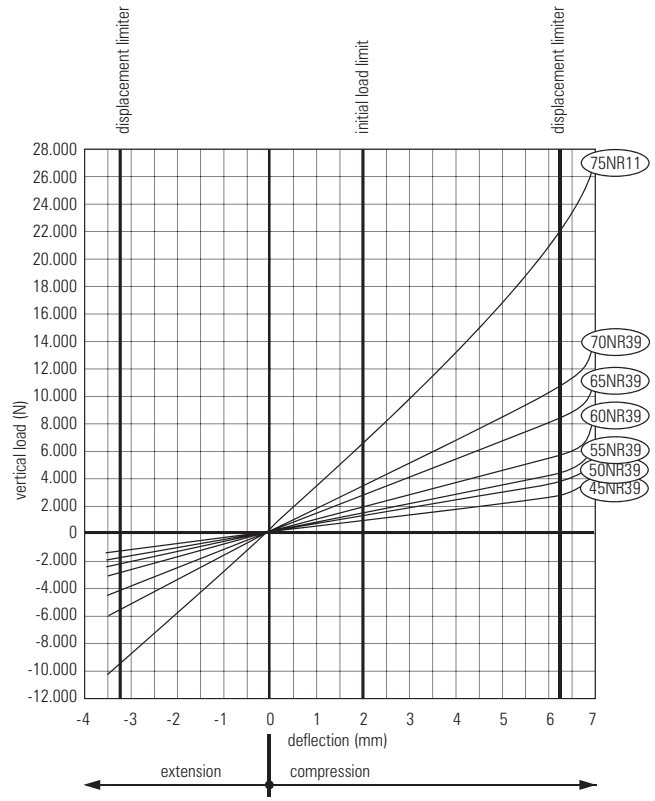
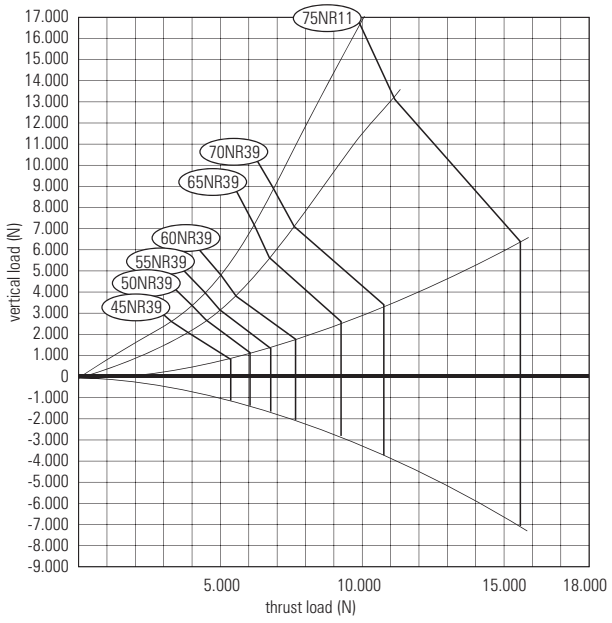
SELECTION CHART

TT mount

type 2



Load - Deflection Curve

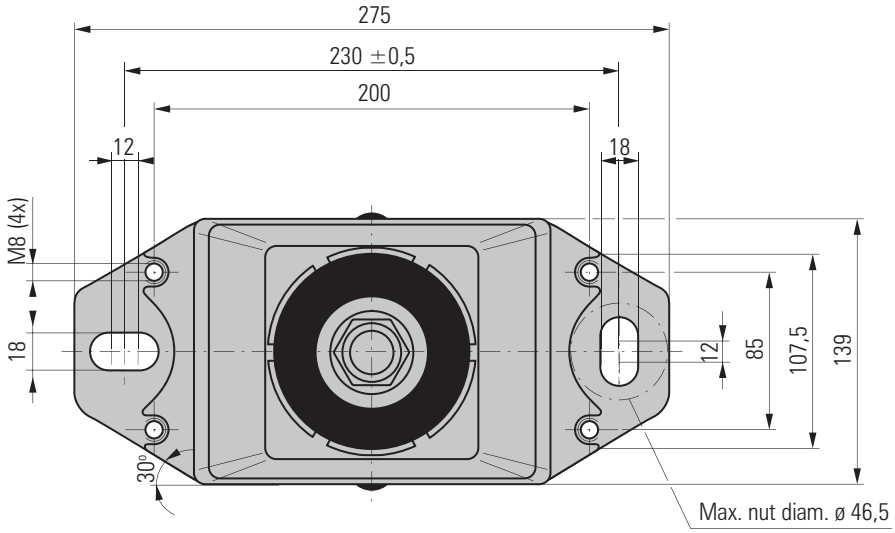


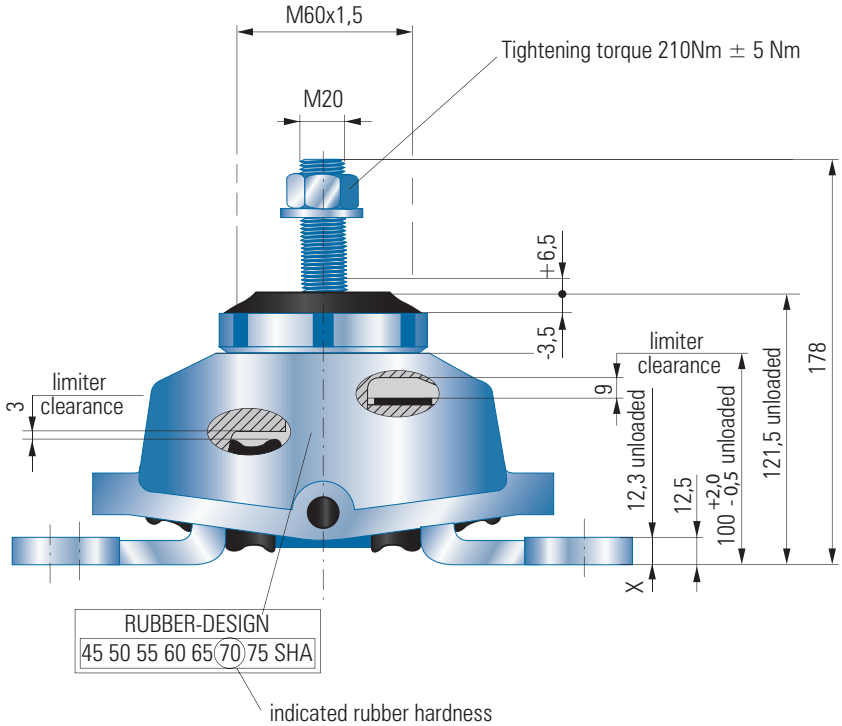
Thrust Load related to vertical load

DIMENSIONS

TT mount

type 3



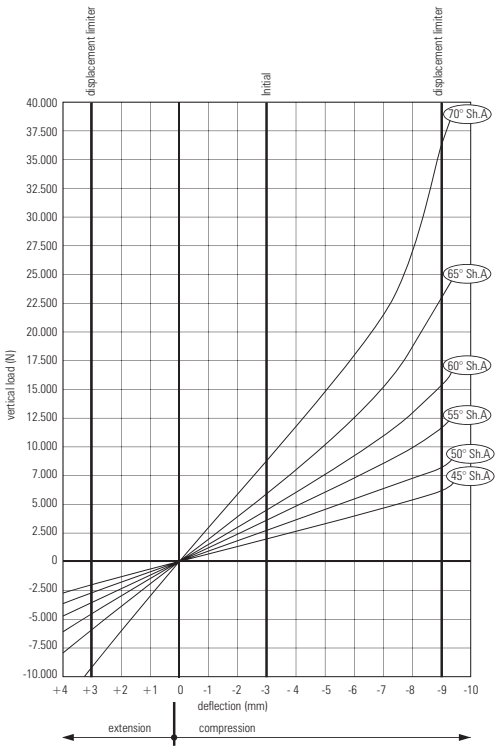


Patent registration nr. 1012075

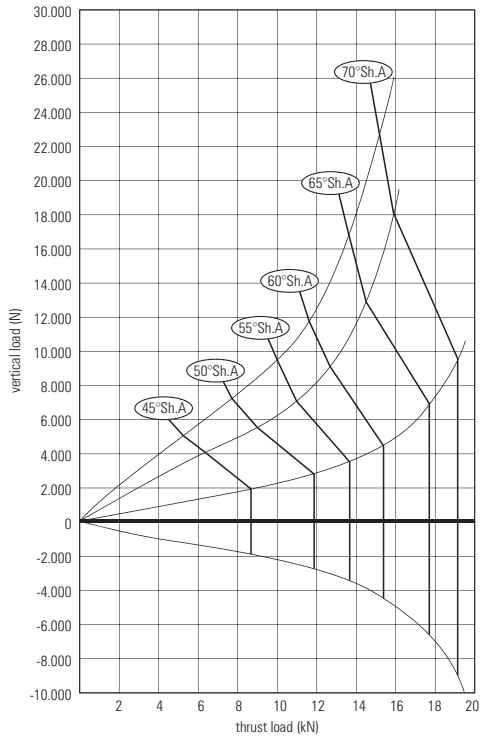
SELECTION CHART

TT mount

type 3



Load - Deflection Curve



Thrust Load related to vertical load

INSTALLATION INSTRUCTIONS

installation instructions

Check the unloaded height of the mount including the height adjustment unit with the dimensions in the documentation and correct if necessary. Install the mounts to the engine / gearbox brackets by means of the central stud and slightly tighten the nut at this stage. For transportation and first alignment it can be of help to install fixing bolts and nuts in the transportation holes, which enables to pre-align semi rigid in the lateral direction. If appropriate, remove the transportation bolts and allow the installation to settle on the mounts for at least 48 hours before any attempt is made to align the installation. Check the dimension of the mounts. Adjust the height of the installation by means of adjusting bolts in the four threaded holes. We recommend the use of a filler plate directly under the full lenght of the mounts, certainly when applying epoxy resin. Underneath this plate any kind of shim can be applied. The lateral (pre-) alignment can best be done with the fixing bolts in the transportation holes at the earlier stage, which makes the job easier and prevents mount distortions. After shimming the mounts, adjustments can still be made to the height of the installation by means of the height adjustment unit and after a period of time to overcome the effects of creep. After alignment the nuts should be tightened to the recommended tightening torque in the documentation which is particularly important for thrust transmitting installations.

MAINTENANCE INSTRUCTIONS

maintenance instructions

Under normal circumstances the mounts will not require more maintenance than a periodical check on oil and grease contamination of the rubber inserts and clearance check between the top casting and foundation. If the X dimension is reduced to 4^{0}_{-1} mm for the TT1 mount, $2.5^{0}_{-0.5}$ mm for the TT2 mount and 3,25 - 0.75 mm for the TT3 mount replacement is recommended. The design of the base- and top castings protects the interchangeable rubber inserts from contamination by for instance oil and fuel. We advise to use only natural based soaps for cleaning in the event of any kind of contamination. Due to severe overload, damaging or longterm oil contamination of the rubber inserts, recognisable on the breakdown of the rubber to metal bond and / or swollen surface. All TT mounts of an installation should be replaced at one time. In this case it is advisable to return the TT mounts completely to Rubber Design for overhaul or part-replacement.

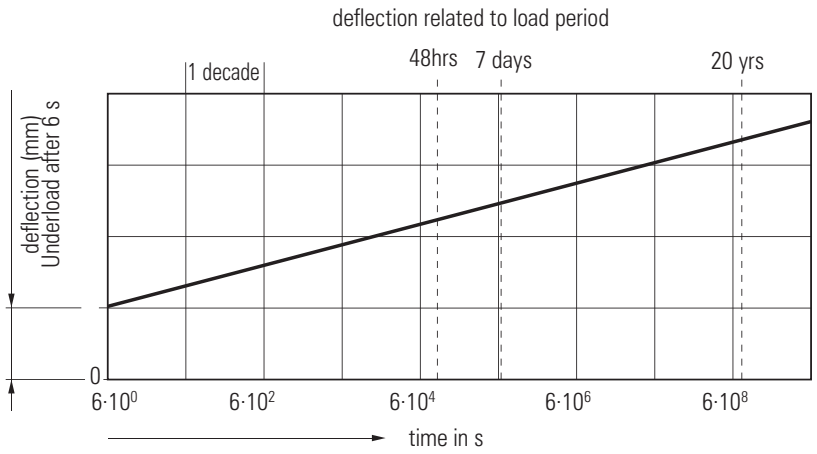
TECHNICAL DATA

dynamic factors ▶

RUBBER HARDNESS	DYNAMIC / STATIC RATIO (shore A)	DYNAMIC MAGNIFIER
40°	1.05 - 1.15	24
45°	1.10 - 1.20	22
50°	1.20 - 1.30	20
55°	1.30 - 1.45	18
60°	1.40 - 1.55	16
65°	1.50 - 1.70	14
70°	1.60 - 1.90	12
75°	1.70 - 2.00	10

typical creep ▶

The typical creep rate of the TT mounts will vary with compound, rubber hardness, dynamic loads, thermal loads and strain. The typical value for the NR39 compounds will be 3% of the static deflection increase per decade. For the NR11 compounds this value will be 4%. 48 hours after loading more than half of the total creep figure over 20 years will be achieved.



typical creep

thermal expansion

The typical thermal expansion rate of the TT mounts will be approximately 0.01 mm / °C increase in height depending on compound, rubber hardness and strain. The expansion rate is directly related to the temperature of the rubber element.

thermoshock

Every temperature exceeding the latest achieved peak temperature will cause a permanent set of the mount of approximately 0.01 mm / °C in the range from 20° to 90° C. For instance the first thermal load from surrounding temperature to normal working temperature will cause an extra set of the deflected height next to the normal creep. Every time the mount temperature is raised to the normal working temperature, no extra set will occur. Once the normal working temperature is exceeded, an extra set will occur again. The permanent set is directly related to the temperature of the rubber element.

TECHNICAL DATA

stiffness ratio's

The stiffness ratio of the TT mounts vary with compound and vertical load imposed on the mount. The subjoined table gives the ratio range for loaded deflections between 0 and 2 x times the initial load limit in mm. In this respect the prescribed tightening torques of the mounts should be kept.

TYPE		Cz	Cx	Cy
TT1	45NR39	1	7.3	1.1
	50NR39	1	7.8	1.2
	55NR39	1	8.5	1.4
	60NR39	1	6.5	1.4
	65NR39	1	5.7	1.4
	70NR39	1	4.2	1.4
TT2	45NR39	1	9.3	1.6
	50NR39	1	8.5	1.4
	55NR39	1	7.9	1.2
	60NR39	1	6.4	1.1
	65NR39	1	5.3	1.1
	70NR39	1	4.5	1.1
	75NR11	1	4.0	1.1
TT3	45NR39	1	8.4	0.9
	50NR39	1	8.7	1.2
	55NR39	1	8.0	1.4
	60NR39	1	6.8	1.5
	65NR39	1	6.0	1.6
	70NR39	1	4.1	1.3