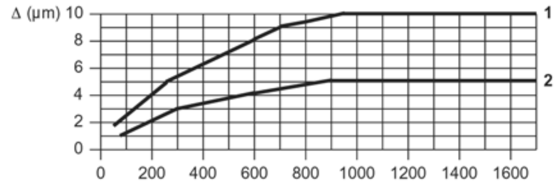
The rails are made of special alloyed steel and through-hardened to a hardness value of 60 ±2 HRC. The precision relative to the parallelism variation between the raceways and the reference surface are dependent upo the quality selected (10 micron/1600 millimeters for the “standard” quality, 5 micron/1600 millimeters for the “selected” quality). It is important to state that all the elements are individually checked during all manufacturing phases before the final inspection. Also, a non-destructive check is performed to assure the absence of internal cracks which may have been generated during heat treating. Such micro-cracks could drastically affect both the precision and the life of the rails.
The advantatges obtained by employing rolling systems can be summarized as follows:
• Very sensitive movement (friction coefficient of 0.003)
• Lack of start-up frictional losses (stick-slip)
• Minimum wear
• High load carrying capacity
• Maximized precision
• Availability in stock of all models included in the catalogue
In our production program we have a full range of standardized cross roller tables with lengths ranging from 25 to 1010 mm and widths of 30 to 145 mm; with load ratings from 250 N to 48100 N. The structural members of the tables are made of cast iron (G25), naturally aged, or of steel.
A range of anticorodal tables is also available; their light mass makes it possible to reduce inertial forces.



Manufacturing tolerances

1. Standard quality
2. Selected quality

The rails are through-hardened to 60 ±2 HRC. The material is alloy steel. (DIN 1.2842) Each rail is accurately checked during all the manufacturing phases and it is subjected to a final inspection where the geometry, hardness, surface texture of raceways and adjacent surfaces are thoroughly checked.

HRC	Fd
20	0,10
30	0,25
40	0,34
45	0,42
50	0,53
55	0,78
57	0,90
58	1,00

Hardness

The rail hardness is of major importance since its variation has a direct influence on the life expectancy of the system.
It is important to know that the best working conditions (Fd = 1) corresponds to a hardness value of 58 HRC minimum.
For hardness lower than 58 HRC, the teorical load rating should be multiplied by the corresponding hardness factor. Therefore, if a rail with a hardness of 55 HRC and theoretical load rating of 3000 N is used, its load rating will be C = 3000 x Fd which corresponds to 3000 x 0.78 thus 2340 N.

TrC°	Ft
300	0,60
250	0,75
120	0,90
80	1,00

Temperature

The temperature also has a great influence on the system life. For temperatures above 80°C the factor Ft should be introduced. The table shows the most common factors if the theoretical load rating of a recirculating ball unit RK 6100 is 715 N such a rating will be reduced to 536,25 N (715x0.75) if the temperature rises to 250°C. Permissible operating temperatures is between -40°C and +80°C.

Acceleration

If all the conditions of the system have been verified, values up to 50 m/sec^2 are allowed.

Speed

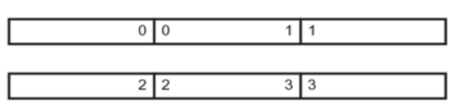
Linear systems utilizing GR type rails could be used for speed up to 50 m/min. If higher speeds are sought, our engineering office should be consulted.

Sealing and protection

It is absolutely necessary that the linear system is protected from impurities of either solid or liquid nature.

Multi-piece ways

For systems requiring longer than standard catalogue rails, multi-piece ways can be provided. To accomplish this, the individual rails are head-ground and ground simultaneously to the required length. By doing so, there will be no difference in precision and smoothness. In case of shipping of multi- piece system, the individual rails will be numbered to allow proper mounting.



Lubrication

The rolling systems are usually lubricated with a thin oil film applied during assembly. This lubrication method allows the better utilization of the precision and smoothness characteristics of such an arrangement. However, should the application dictate it, oil-drip, oil-mist or lithium based greases (KP2K - DIN 51502-51825) can be used.

Preload

Usually the preload is applied with set screws placed in correspondence of the mounting screws by using appropriate dynamometric spanners. A system could also be preloaded by means of a tapered gib, a wedge of cylinder, though all of these methods are more complex and require a more accurate execution of the supporting structure. Such accuracy may not be achievable or even wanted by the user. The preload setting is usually dictated by the application and can very between 2% and 20% of the dynamic load rating of the system examined.

Life

We have already examined two of the factors which may affect life of a rolling system (temperature and hardness). In addition, we like to mention others which are also important.

1) Manufacturing tolerances of the supporting surfaces non-respondent to the minimum requirements.
2) Mounting not according to our recommendations.
3) Presence of particles or impurities between the rolling elements.
4) The system should not be subjected to its maximum allowable load until after a break-in period to allow proper adjustment of the system itself.

In these conditions are respected the life of a system can be calculated according to the following formula:

$$L = FD \times \left(\frac{P}{F1}\right)^{p} \times 2{,}5 \text{ in } 10^5 \text{ (m)}$$

L = Basic rated life 10^5 (m)
FD = Reliability factor
P = Dinamic load rating (N)
F1 = Dynamic load (N)
p = Life exponent (10/3 for rollers, 3 for balls)

Example: Given - Roller 9 mm
P = 1300 N
F1 = 200 N
Rail hardness = 58 HRC
Temperature = 100°C
Reliability FD 90% = 1

%	FD
90	1,00
95	0,62
96	0,53
97	0,44
98	0,33
99	0,21

$$L = 1 \times \left(\frac{1300}{200}\right)^{10/3} \times 10^5 = 513 \text{ in } 10^5 \text{ (m)}$$

To circulate the theorical life in hours, the formula is:

$$Lh = L \times \frac{8{,}33}{C \times Nc}$$

Where
Lh = Basic rated life (hours)
C = Stroke length (mm)
Nc = Frequency of reciprocating motion in 1 minute

Example:
Stroke = 400 mm
Frequency = 30

$$L = 513 \times 10^5 \text{ m}$$

$$Lh = \frac{8{,}33 \times 513 \times 10^5}{400 \times 30} = 35610 \text{ h}$$