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HepcoMotion® PRT2 1-TRAK GUIDED MOTION SYSTEM

September 2023



EXPERTLY DESIGNED, DELIVERED TO PERFORM

Powered by over 70 years of relentless problem-solving and steadfast reliability, Bishop-Wisecarver delivers innovative motion solutions around the world that thrive in harsh and extreme conditions. Our linear and rotary motion solutions, custom complex assemblies, and embedded intelligence systems lead the manufacturing industry, and they are backed by The Signature Experience promise of expert guidance, confidence and customer satisfaction.

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When you purchase from Bishop-Wisecarver, you aren't just getting a product that works; you're getting products, systems, and industry-leading expertise you can trust, especially in harsh conditions and critical environments—always exceeding our customers' reliability requirements.

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HARSH ENVIRONMENTS



SMOOTH, LOW FRICTION MOTION



LONG LENGTH



MOIST ENVIRONMENTS



LOW NOISE



FOOD GRADE



HIGH/LOW TEMPERATURE



CLEAN ROOM



LOW TOTAL COST OF OWNERSHIP



VACUUM

INTRODUCTION

PRT2 1-Trak is an innovative guided motion system that further enhances the acclaimed HepcoMotion[®] PRT2 range of ring and track solutions. 1-Trak, a single piece track system, is completely seamless and free running with no possibility of misalignment during installation or in service, resulting in smoother, quieter motion.

While conventional track technology limits track paths to simple combinations of straight and curved track segments, 1-Trak allows any conceivable 2D shape to be realized.



Features and Design Benefits

- Tracks which are made in one piece, without joints
- Tracks with integral base to form the structural part of a machine
- Tracks which can follow almost any conceivable 2 dimensional path
- Tracks with a vee profiled section of any size to suit bearings from Ø13 to 150mm
- Tracks with a rectangular profile and roller carriages, for use in tandem with vee profiled systems to compensate for parallelism tolerances
- Track systems with no play between carriage wheels and the track, anywhere around the circuit
- Corrosion resistant tracks, carriages and bearings options

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Need Help

Application + Design Assistance 925.439.8272

3D Modeling + CAD Drawing BWC.com

ONE PIECE TRACKS WITH INTEGRAL BASE PLATE

PRT2 1-Trak systems are precision machined in one piece from very high grade steel and are surface hardened for wear resistance. A unique manufacturing approach ensures high accuracy and close tolerances on straightness, flatness, and shape.

This construction eliminates assembly due to the absence of joints, with no possibility of misalignment during installation or in service.

1-Trak is made from a single piece of steel so that the track is one with the base plate. This gives a very strong and accurate foundation which can be the key structural element of a machine. It can be made to a customer's design with holes, slots, and other features, and can be supplied mounted to a HepcoMotion MCS frame.



THREE BEARING CARRIAGE GEOMETRY

A key innovation of the PRT2 1-Trak design is the three bearing carriage. This offers great flexibility, but at the expense of reduced load capacity compared to a four bearing carriage. The reduction depends on the load configuration, but 25% is typical.

In a conventional PRT2 track system, the width of straight and curved sections in one track is always the same. When fixed center (FCC type) carriages are used, a small amount of play is experienced at the straight-to-curve transitions, but not elsewhere.

In a 1-Trak three bearing system, the track width constantly changes depending on the bend radius, to eliminate play. In the track system below, the widths of the track at positions A, B, C and D are all different, and the carriage travels with all three wheels in uniform contact all of the way round the circuit.



The concept is very simple, but its design and manufacture require innovative and sophisticated methods which are newly developed by HepcoMotion and patent pending.

The use of three bearing carriage geometry provides many advantages:

- Carriages have zero play at all positions on the track.
- A track system can follow almost any two dimensional path, including straight sections, curves of differing radii, reverse bends and free-form curves.
- Track systems can have much tighter bends than is possible with other designs, saving space and cost.
- For tracks with both left and right hand bends, in lower load situations, three bearing carriages are a simple low cost alternative to bogie carriages.
- Tracks can be made in a wide section to give higher moment load capability.



TRACK SYSTEMS WITH COMPLETE SIZE FLEXIBILITY

Standard PRT2 track system components are produced in volume and are the popular choice for most rectangular and oval circuits, where the straight and curved slides can use standard radii and section widths. The 1-Trak approach, however, provides complete flexibility to chose dimensions to meet exactly the requirements of the application.

Generally, 1-Trak systems are more expensive than similar standard PRT2 tracks, but smaller systems made in volume may cost less.

With the 1-Track system, it is possible to have very wide slide sections with bearings which are widely spaced both across and along the carriage. This will provide a very rigid platform and increase moment load capacity. Such carriage design can negotiate curves with a much smaller bend radius than is possible using conventional designs. Reduced bend radii allow machines to be made smaller, which saves space, cost and can improve speed of operation.

Carriages with all three bearings of the same size, have an asymmetric load capacity. In such cases, the single bearing of the three bearing format which is usually on the inside of the circuit, will be the life-determining factor.

By specifying a larger size single bearing, it is possible to achieve a more equal load capacity across the carriage and more load capacity overall.

The example system shown below has widely spaced bearings, a tight bend radius, uses a larger bearing on the inside of the track and also has an integral base plate. It therefore uses many of the positive features of the PRT2 1-Trak approach.



A further useful version of PRT2 1-Trak is shown below. In this design, the carriage fits inside a channel-section track which has inward-facing vees that engage with the bearings. The advantage of this configuration is that the contact points between bearings and slide vees are spaced very far apart, giving higher moment load capacity and stiffness.

PRT2 1-Trak systems can be made in a huge range of sizes, using bearings from Ø13, through 18, 25, 34, 54, 64, 95, 120, 128 to 150mm. These bearings are taken from the HepcoMotion PRT2 & HDS2 ranges. Individual bearing capacities are given on page 11. Customers should discuss system load capacity with Bishop-Wisecarver's Technical Department.

Visit www.bwc.com to view these catalogs.



TRACK SYSTEMS WITH RACK & PINION DRIVE

PRT2 1-Trak is also available with a rack and pinion driven carriage.

Uniquely, the 1-Trak design allows correct and constant mesh between pinion and rack all around the circuit. Unlike other systems, the pitch line of the rack follows a complex path in unison with that of the pinion. Therefore, there is no requirement to have the pinion sprung against the rack to compensate for varying engagement. This hugely simplifies the carriage design, and increases load capacity.

The gear teeth on the track are precision machined and surface hardened to produce outstanding strength and durability. When used with a hardened pinion and properly lubricated, high driving forces, minimal backlash and long life will be achieved. MOD1.5 gear teeth up to 6mm wide are possible for smaller systems.

For larger gears, MOD2 teeth up to 8mm, MOD3 teeth up to 12mm, MOD5 teeth up to 20mm, MOD8 teeth up to 33mm, and MOD10 teeth up to 40mm wide are recommended.



Bishop-Wisecarver can supply the pinions alone, carriages complete with pinion and drive flange, or with the pinions mounted onto a gearbox or geared motor. Guidance on gear and pinion specification, and information on load capacity and life expectancy are available from an Applications Engineer.





TRACK SYSTEMS USED IN PARALLEL

When vee profiled track systems are mounted in parallel onto a rigid support, any installation parallelism errors can result in the preloading of the system. This may cause binding, excessive loading of bearings and increased friction.

To address this issue, PRT2 1-Trak systems can be made with a rectangular profile using carriages with HepcoMotion GV3 track rollers. This design provides precise, play-free guidance for movement around the track, but allows freedom for the carriages to move in the direction of the roller axes. An example is shown below:

This type of track system is shown in parallel with a Vee profiled track, in the arrangement below. The rectangular section track system ensures than no preloading stresses are created. This will improve the running quality, friction, life and ease-ofinstallation of such systems.



The methods of manufacture, materials, and size capability are the same for rectangular track systems as they are for vee profiled ones. They should be specified as a set, with the rectangular and Vee profiled tracks being made to match. In these sets, the diameters of the rollers and Vee bearings will usually be the same.

In this type of system, it can be beneficial to have a gear drive on both track systems, with the driving pinions connected together, either using a common drive shaft, or with separate servo drives and linked controls. This approach can eliminate the distortion which can occur if drive comes from one side only.



The following is intended as a guide and customers are requested to involve a Bishop-Wisecarver Applications Engineer in the final specification before ordering. Communication is best assisted by submission of a sketch.

1-Trak systems are made to order and Bishop-Wisecarver will produce a drawing for approval prior to manufacture.

- **Specify the Carriage:** For bearing sizes, part numbers and capacities see table page 11. For other information see PRT2 catalog or speak to an Applications Engineer directly.
- **Pair of Concentric (Non Adjustable) Bearings:** Specify the part number and whether the bearings face inside or outside the circuit.
- **Single Eccentric (Adjustable) Bearing:** Consider whether this should be the same size as the pair of concentric bearings, for asymmetrical load bearing or a larger size to achieve symmetrical load bearing capability. Specify the part number.
- Bearing Positions: Specify dimensions X & Y (see drawing).
- **Carriage Dimensions:** Specify dimensions L, W, T & H (see drawing).
- Specify the Number of Carriages on the Circuit
- **Specify the Track:** The carriage information specified above, will automatically define the track section.
- **Specify the Track Shape:** The shape is defined by the path of the center of the pair of bearings, as shown in the drawing above. This is best communicated using a sketch showing the relevant dimensions (e.g. straight length S and radius R). The pair of bearings can follow (subject to limits imposed by the bearing diameter) any 2-D path including ellipses, spirals, parabolas and B-splines. For track designs which include such shapes, a CAD file of the required path should be provided. It is also possible to produce a track system where another point on the carriage follows the defined path. In these cases, the position of that point should be advised along with details of the path required.
- **Specify Integral Base & Customization Requirements:** Please provide a sketch showing details and dimensions of all holes, slots, cut outs and special carriage shape requirements. Also, details of the integral base if required, including overall dimensions within the size limitations stated on page 4. To minimize cost, customers are encouraged to specify systems where the overall thickness is at or below one of the following sizes: 9, 12.5, 18, 25 & 36mm. Other sizes are possible up to 100mm thick.

SPECIFYING A PRT2 1-TRAK SYSTEM



- **Lubrication Options:** An oil film on the running surfaces of the vees is essential for the 1-Trak system in order to reduce wear and prolong life. This can be achieved by the following methods and should be discussed first, with Bishop-Wisecarver's application engineers.
- **Lubricators:** In many cases, PRT2 Lubricators can be fitted to the carriage (see PRT2 catalog). However, this is only possible in systems without tight bends, due to limited stroke of the wipers.
- **Bleed Lubrication:** This system channels lubricant directly to the vees of the track and can be incorporated on most 1-Trak systems.
- **Gear Driven Option:** The gears on a 1-Trak system have enhanced load capacity due to surface hardness. This increases life and gives superior performance. Bishop-Wisecarver will provide calculations of load capacity and life for specific applications. To define the gear, it is only necessary to specify the pinion size required, its position on the carriage, the face width of the gear (see information on page 5) and whether the gear is facing inwards or outwards. Note that the pinion may be positioned away from the center of the carriage. A range of hardened pinions can be found in the HepcoMotion HDS2 catalog. Bishop-Wisecarver has a range of geared motors, gearboxes and drive flanges available to cater for most drive requirements. Please see the HepcoMotion GV3 and HDS2 catalogs.

Materials and Finishes

Standard PRT2 1-Trak systems are made from a high grade of steel and have a precision machined finish. A corrosion resistant finish is available for the tracks.

The vee bearings and track rollers are all available in standard and stainless steel variants.

Carriage plates can be manufactured in any convenient engineering material, but the default choice is high strength aluminum, with a clear anodized finish. An enhanced corrosion resistant treatment is available if required.

Loads and Life

The loading on individual bearings in a 3 bearing carriage can be determined using a standard statics calculation method, with the loads resolved into axial (LA) and radial (LR) components (see right).



The maximum load capacities of the bearings are shown in the table below:

Axial Load

Radial Load

	Load Capacities for Double Row Bearings (N)			Load Capacities for Twin Standard Bearings (N)		
Bearing Part Number	Lubricated			Lubricated		
	La (max) N	Lr (max) N	Basic Life km	LA (max) N	Lr (max) N	Basic Life km
J13	-	-	-	60	120	50
J18	190	600	100	125	200	100
J25	400	1500	70	320	600	50
J34	900	3000	250	800	1400	100
J54	2500	5000	500	1800	3200	250
J64	2500	8000	500	-	-	-
J95	7000	20 000	400	-	-	-
J120	10 000	30 000	700	-	-	-
J128	10 000	30 000	700	-	-	-
J150	17 000	50 000	2000	-	-	-

The working load capacity system life is calculated following the approach detailed on pages 2 & 3 of the PRT2 Load Life Information datasheet (please visit <u>www.bwc.com</u>).

The load capacity and life of 1-Trak systems with rectangular profiled tracks are determined by the track rollers which run on them. The performance of these rollers is detailed in the HepcoMotion GV3 catalog (please visit <u>www.bwc.com</u>).

For further information and assistance, please contact Bishop-Wisecarver.

Bishop-Wisecarver® is proud to be the exclusive North American distributor of HepcoMotion® products since 1984.

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