

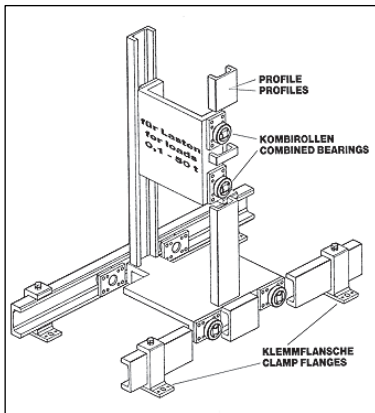
WINKEL Linear Systems

Overview

- Combined Bearings & Profiles for linear movement - horizontal or vertical
- Economical assembly / simple design
- Handles heavy static & dynamic loads
- Bearings allow adjustment for positioning – Bearing also easily replaced.
- Precision Profiles (machined bearing surfaces allow for refined bearing fit for precise linear movement
- Convenient accessories allow installation & mounting options
- CAD drawing download from Web Site
- Full product line stocked in Charlotte, NC.



Design Concept



Combined bearings, like units shown at the right, designed to fit precisely into channels or I-beam profiles, minimize the number of components needed to guide linear movement.

Combined bearings, available in a variety of sizes (diameters) and different styles, offer a variety of features including: re-lube feature, internally or externally adjustable (to simplify installation fits), high temp capable, and stainless for corrosive or wash-down applications. Other bearing units have Vulkollan (rubber coated) wheels for quiet operation.



Profile Size is an Important Design Consideration

In the design of a Linear System using Winkel Bearings & Profiles, loads must be determined first. Once the basic load per bearing location is known, including safety factors for overload or shock conditions, they can be used to select the profile. The profile is ST52-3 Nb or V1027M, is similar to C1027 Steel, which is very weld-able. Our profiles have higher levels of vanadium and manganese to make them harder than the typical C1027 material. The profiles are made in Germany. The pressure (bearing contact) on the profile from the load is the limiting design factor. We call this pressure the Hertz pressure at the contact point. The Profile and Bearing Selection Chart 1 gives the profile sizes & max load capabilities of the profiles in the columns labeled, F_N Radial & F_N Axial. Staying below the profile max rating will determine the bearing size – select the complimentary bearing from columns to the left. PTI Stocks 14 different standard profiles cross-sections in Charlotte NC.



Profile and Combined Bearing Load Ratings

Chart 1

Radial Bearing	Combined Bearing Axial Bearing Fixed	Combined Bearing Axial Bearing Adjustable	Combined Bearing Axial Brg Adjustable by Washer	Combined Bearing with Eccentric Bearing	Combined Bearing with combined bolt	F _R KN Max Static Radial Load (N)	F _A KN Max Static Axial Load (N)	Profile Type		
								Standard	Precision	I-beam
-	4.052 P	-	-	-	-	0.8	0.4	A	-	-
-	4.053	-	-	-	-	5.23	1.68	S	-	-
(PR) 2.054	(PR) 4.054	(PR) 4.454	(PR) 4.072	JC 4.054	KB (PR) 4.072	9.40	3.1	0 NB	PR 0 NB	-
(PR) 2.055	(PR) 4.055	(PR) 4.455	(PR) 4.073	JC 4.055	KB (PR) 4.073	11.30 (8.59)	3.73 (2.86)	1 NB	PR 1 NB	(3018)
(PR) 2.056	(PR) 4.056	(PR) 4.456	(PR) 4.074	JC 4.056	KB (PR) 4.074	11.72	3.87	2 NB	PR 2 NB	-
-	4.057	4.057	4.075	-	-	(8.92)	(2.97)	-	-	(3019)
(PR) 2.058	(PR) 4.058	(PR) 4.458	(PR) 4.076	JC 4.058	KB (PR) 4.076	20.47 (15.57)	6.76 (5.19)	3 NB	PR 3 NB	(3020)
-	4.059	4.059	4.077	-	-	(15.47)	(5.15)	-	-	(2912)
-	4.06	4.060	4.078	-	-	(16.49)	(5.49)	-	-	(3100)
(PR) 2.061	(PR) 4.061	(PR) 4.461	(PR) 4.0784	JC 4.061	KB (PR) 4.0784	21.68	7.16	4 NB	PR 4 NB	-
(PR) 2.062	(PR) 4.062	(PR) 4.462	(PR) 4.079	JC 4.062	KB (PR) 4.079	30.92 (23.52)	10.20 (7.84)	5 NB	PR 5 NB	(3353)
(PR) 2.063	(PR) 4.063	(PR) 4.463	-	JC 4.063	-	54.02	17.8	6 NB	PR 6 NB	-
-	-	-	(PR) 4.080	-	KB (PR) 4.080	37.81	17.8	6 NB	PR 6 NB	-
-	-	(PR) 4.085	-	-	-	64.7	19.4	8 NB	PR 8 NB	-
-	-	4.089	-	-	-	41.71	13.91	10	-	-
-	-	4.090	-	-	-	58	19.4	16	-	-
-	-	4.091	-	-	-	84	28	18	-	-
-	-	4.092	-	-	-	101.5	33.9	28	-	-
-	-	4.093	-	-	-	139.4	46.5	36	42	-

Notes:

(PR) indicates this applisd to PR (precision) Bearing also.

F_R KN = Max Static Radial Load allowed on the Profile.

F_A KN = Max Static Axial (Thrust) Load allowed on the Profile

I-Beam profile data are all listed in parenthesis.

Chart 1 lists maximum point load capabilities in (N) Newton's for each profile for both Radial and Axial loads. (Remember 1 lbf pound force = 4.4 Newton's, or multiply Newton's by 0.2248 to get pounds force lbf). Staying under this maximum load limit (we suggested approx. 80% of the max) will yield virtually infinite profile life. Generally the radial load is the heaviest and most important load to consider. Exceeding the load limits of the profile could brinell or indent the channel which will eventually become worse over time as the bearing rolls over the indented area. We call this the "washboard" effect.

Bearing Selection

Referring to Chart 1 again, once the Profile size has been chosen and a safety factor included the bearing type and size that fits the channel can be selected. So, select the bearing size in the columns to the left of the profile size, being sure to stay with the chosen profile size. The bearings listed all have slightly different features and the differences will be discussed next.

Profiles are not hardened and cannot be hardened. The bearings, made from normal bearing steels, are harder than the profiles. So the bearing is capable of heavier loads than the profiles. So, if the bearings will run on hardened steel channels, (made by the customer), the bearing load limits may be possible. Please discuss these applications with PTI for additional details. The majority of systems use our standard profiles which PTI stocks in 6 meter lengths. Longer lengths are possible as a special order.

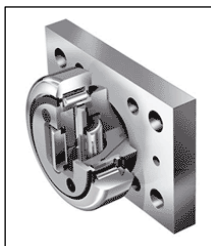
If you have paged thru the catalog, you have seen a wide assortment of bearings. As bearings get larger they naturally handle more loads. Since linear systems generally run slow, at least far as the bearing is concerned, the speed limit is rarely exceeded, the bearing features become important consideration is the design of the system.

Winkel Linear bearings are called combined bearings because most have a cylindrical roller bearing as well as a thrust bearing with in the same unit. Hence, combined units are compact and rather economical for their capability.

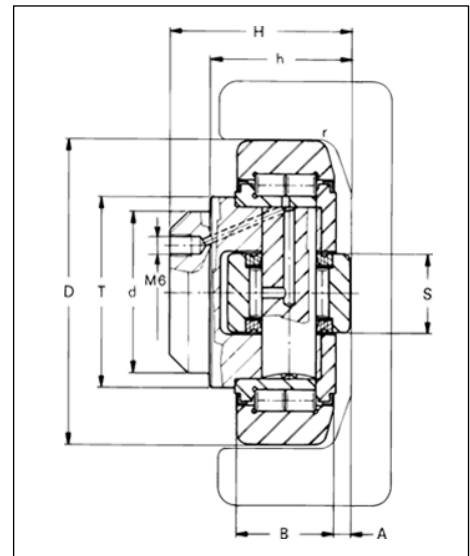
Axial Bearing Fixed



The most popular combined bearing is the **Axial Bearing Fixed** unit. The unit is a combination of a cylindrical roller bearing that handle heavy radial loads and a needle bearing in the face roller for thrust or axial type loads. The bearing fits into the profile as shown at the right. The thrust bearing will handle the side to side loads as the system traverses or moves within the profile. The thrust bearings roll against the inner surface of the profile, guiding the axial position of the system.



The **Axial Bearing Fixed**, like many of the combined units in stock, is also available with flange plates. The rectangular flange plates, historically the most popular, allow simple mounting to the system frame work.



The new square flange plate version has only threaded holes for bolting from the back and the rectangular plate has both clearance holes for thru bolt mounting as well as the threaded holes.



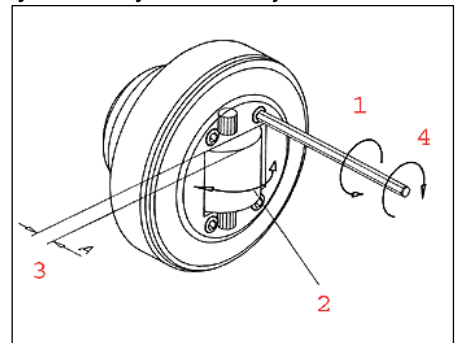
During installation it may be necessary to adjust the position of the bearings if axial adjustment becomes necessary to improve the position of the bearing within the profile.

Washers or shims are available to slip behind the flange plate. Shims, shown in the square Flange plate version, are available for every flange plate size in 0.5mm and 1.0mm thicknesses to help provide simple axial position of the bearing. The shim becomes the adjustment means to minimize or limit side-play in the system. Bearing sizes 4.055 and larger can be re-lubricated via a lube plug on the back of the stud or back side of the flanged unit.

Axial Bearing Eccentric Adjustable



The **Axial Bearing Eccentric Adjustable** unit has a thrust bearing on an eccentric stud or cam that can be rotated causing the thrust bearing to move in and out to adjust the axial play in the system. Adjustment is simple. Loosen and remove the face plate screws. The thrust bearing and shaft on which it's mounted can be removed and rotated then re-inserted. The shaft is a cam surface which allows the bearing to protrude more or less as the unit is rotated. Once the desired adjustment is reached, the face plate can be re-installed.



On a typical 4 bearing system, it is common to have 2 Fixed bearings (the first type we discussed) and 2 Adjustable type units so axial positioning or adjustment is handled by the bearing rather than by just shims. Shims can also be used if additional adjustment is needed. If only fixed bearings are used, then shims are used to refine the bearing fit within the profiles. Axial Eccentric Bearings are lubricated for life.

Eccentric Adjustable Bearings cost a little more than the Axial Fixed version, however they offer some unique ability. Should the system need further adjustment, the adjustment means is built in. The same rectangular and square flanges are used as in the Axial Fixed units.

Bearing & Flange Plate Nomenclature

Since the rectangular and square flanges plates can be used on the different bearings, let's review the nomenclature briefly. AP 0 means a rectangular flange plate for profile 0. AP 1 is a rectangular flange plate for a bearing that fits profile 1 and so on. There is basically one Flange Plate size for each bearing size. The new Square flange plates are described as **APQ-0** and **APQ-1**. Q indicates the plate is square.

So a bearing without a flange plate is written 4.055 and with a flange plate 4.055/AP-1 and with a square plate 4.055/APQ-1. Lastly, at PTI we add a "W-" as a prefix so all of the Winkel

components sort together in our system. So the Fixed Bearing Part No. is **W-4.055** and the Part No. with a flange plate is **W-4.055/AP1**.

Flange plates are perfectly aligned on the bearing shaft so they run true in the profile. PTI stocks units with and without flange plates and keep flange plates as separate item.

Axial Bearing Adjustable by a face shim(s)

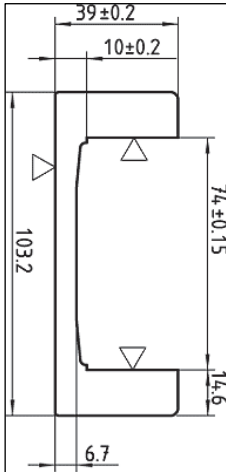


The **Combined Axial Bearing Adjustable by Shims** is adjusted by face washer or shim(s) positioned behind the axial thrust bearing cartridge as shown at left. This is another adjustment option. These are not as popular as the first two types, but the unique adjustment feature will allow for simple adjustment after the bearing is already installed. So this may be a very helpful installation or adjustment feature. Now that you have seen three bearing types, each allowing for axial adjustment a little differently, and what may work better for your customers' application, let's review a few other options or features that are possible.

High Temp Capability.

Metal seals, C3 internal clearance and High Temp Lube will allow combined bearings to operate in applications to 250°C (xxxxx°F). These bearing will have an HT suffix added to the part number, for example W-4.055HT. Axial Fixed Bearing from 4.055HT thru 4.063HT can be re-lubricated. All can be with or without flanges.

Precision Profile and Precision Combined Bearings



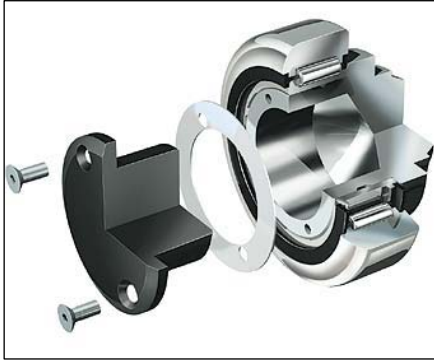
Precision Profile is standard profile that has been machined on the internal bearing contact surfaces and typically on the back mounting face. So the machined surfaces are indicated in the profile at the left. The profile part number then becomes **W- PR 1 Nb**. The PR Bearings have slightly larger OD's than the standard bearings so they fit in the machined profile in a more precise refined manner. The bearing quality is the same between standard and precision. It's just the improved fit with PR bearings i.e. less radial clearance between the bearing and profile. Sp the Precision bearing Part No. with a flange plate is **W-PR4.055/AP1**. So the PR profile and bearing fit is closely controlled. The standard bearing and profile have a radial clearance of approx. 1mm. The precision fit units have approx 0.3mm of clearance, so a refined bearing to profile fit.

Precision units are used where more precise system movement is required.

The same loading criteria apply to the PR profile and bearings. Precision profile is usually machined per order. As lengths may vary and customers frequently request special holes or additional machined surfaces on profiles. The standard profile is stock, and machining for PR profiles is simple and rather quick.

These are the most popular of the Winkel Combined Bearing and Profile types. So now that you are some what familiar with the concept of a bearing that runs in a channel, the rest of the parts can be covered quickly.

Oilamide Thrust Bearing



The **Oilamide Thrust Bearing** Unit uses an Oilamide insert as the thrust face for the contact bearing. Axial adjustment is possible with the use of round shims placed behind the Oilamide insert. This is simple polyamide face that keeps the bearings centered in the profile channels. The catalog provides both Radial and Thrust load ratings. Flange plates can be added to any of the units, all from PTI stock.

Part Numbers range from **W-4.072P** thru **W-4.080P**. Flange plates are the familiar AP1 or APQ3 suffix to the part number.

Radial Bearings



Radial Bearings can be used where no thrust or side loading capability is needed. They utilize the same internal cylindrical bearings for exceptional radial load capability. Larger sizes come standard with the re-lube feature. Flange Plates can be supplied with any of the Radial Bearing units similar to the previous combined bearing already discussed. The typical Part No. from **W-2.054** thru **W-2.063**. For flange plates, just add the AP suffix and size as above. The catalog shows these options.

CAD Drawing down-loads are available from the www.winkel.de web site.

Vulkollan Combined Bearings



Vulkollan Combined Bearings are lighter duty units compared to the standard Axial Fixed and Adjustable types. However, these bearings are silent in operation due to the Vulkollan coating on the rollers. They allow travel up to 3 meters per sec (10 ft / sec) and under light loads, could travel faster. These bearings are sealed for life. Units and the coated



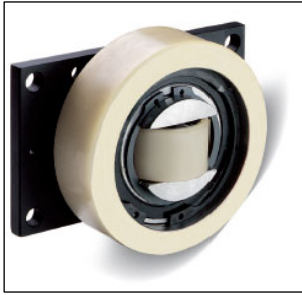
wheels are very wear resistant.

Selection is by the load rating of the bearing rather than the profile rating. Max Radial and Thrust loads are listed in the catalog. Configurations will vary by size somewhat but the function is



basically the same – Radial bearing for the heavier load and a thrust bearing help keep the system in axial position within the profile. Once the bearing size is chosen, the profile is known. Application at left shows how both the radial bearing (larger wheel) within the profile supports the primary load, and the face roller will keep the system adjusted. This combination performs the same function as cam followers. The max temp capability of the Vulkollan bearing is 80°C (176°F).

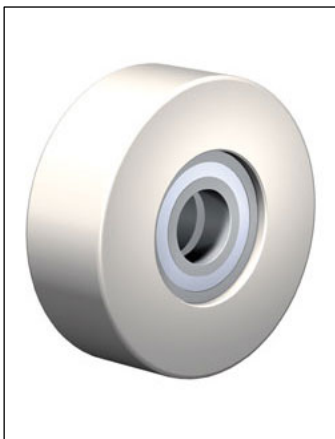
Polyamide Combined Bearings



Polyamide Combined Bearings are the newest edition to the Winkel line of bearings. They are similar to the Vulkollan units in concept and selection. The Polyamide coated bearings allow travel speeds to 5 meters per second (16 ft per/sec). They operate silently and are very wear resistant. Ball Bearings are sealed for life.

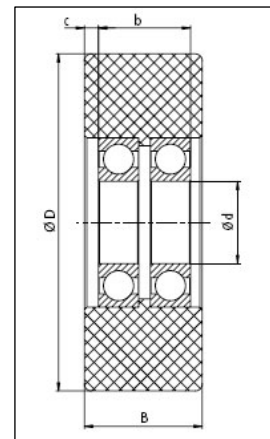
Like the Vulkollan units, they are available in various configurations including flange plates. Selection is based on bearing loads. Polyamide units are capable of heavier loads than Vulkollan units. Max operating washing temp is 40°C (104°F).

Nomenclature: **W-PA1012AP**, where AP indicated there is a flange plate included.



The polyamide series also includes individual rollers that can be fitted into the customers' frames or machinery. These rollers have separate load capacity ratings. Consult the catalog

Profiles for the Polyamide are the same as used with the Vulkollan Series. The profile channels are all made from FE360B steel. PTI stock lengths of 6 meters and longer lengths are possible. Cut lengths to suit needs are normally provided. Call profile is sand blasted, ready to install and paint.



Stainless Steel Combined Bearings and Profile



There are 3 sizes of **Stainless Combined Bearings** and profiles. Bearing selections is also predicated on the bearing capacity in Radial and Thrust loads. Units are available with and without flange plates.

Bearings and profiles are from SS304 stainless material, so rather good of corrosion protection. Thrust bearings in the Combined Stainless Units are corrosion resistant, self lubricating polyamide material. For load capability see the catalog.



CAD Drawing downloads are possible from www.winkel.de

Clamp Flanges & Profile



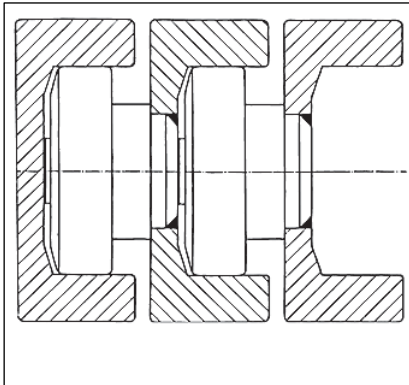
Clamp Flanges, as show in the photo at the left, offer a simple mounting system to install standard and precision profiles. PTI stocks Clamp Flanges for each profile size. By design, they allow easy positioning, adjustment and removal features.

All of the Winkel Profiles are available in 6 meter lengths from stock in Charlotte NC and up to 12 meter lengths are possible with a rather short lead time. Longer than 12 meter lengths are possible and are based on production

schedules and volume. PTI offers profile cut to length so they are ready to install as they are received. All of our profiles are sand blasted and ready to paint.



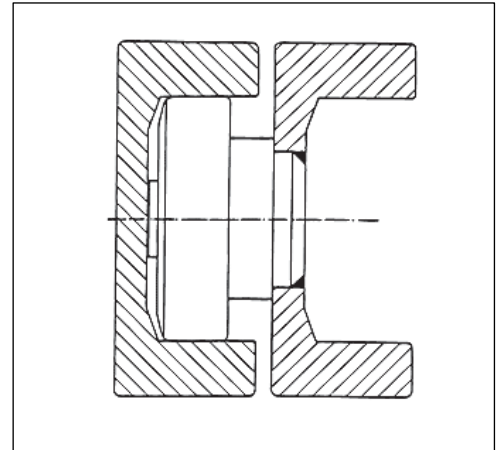
Typical Applications



Winkel Bearings and Profiles are used in a wide variety of applications and industries. The following photos are typical examples of how linear systems utilize Winkel Combined Bearings and Profiles.

Combined Roller Bearings units can handle extreme loads and simplify system

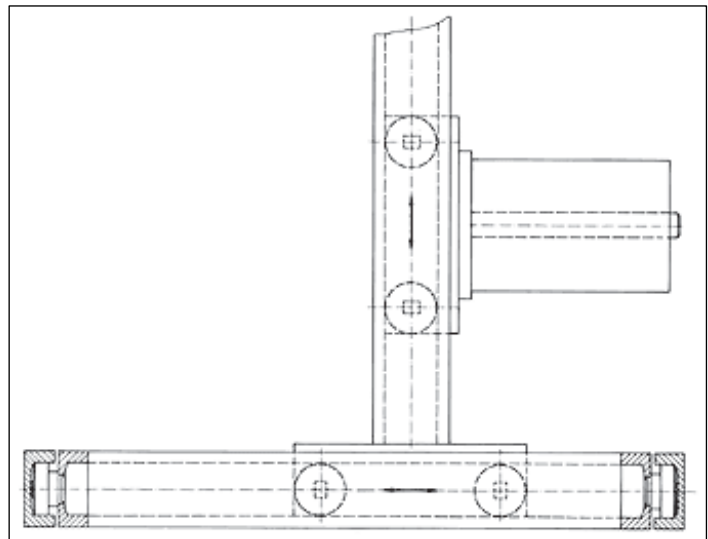
movement. They are easy to install and when sized properly, will virtually last forever.



Typical industries or application include Material handling, palletizing, lifting & positioning, Automotive machinery, Custom Design equipment, Airline catering vehicle mechanism, to name few.

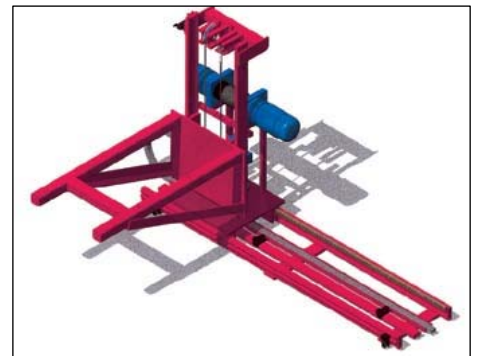
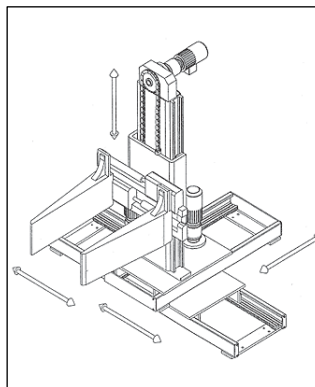
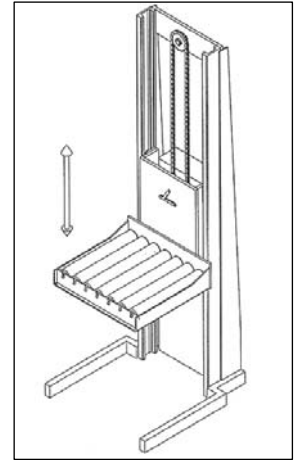
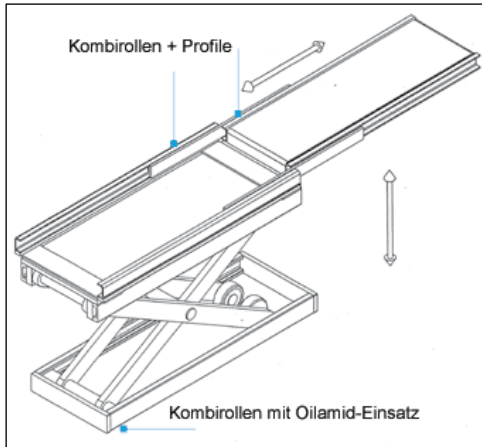
Several typical concepts are included below just to give design concepts.

Let PTI know what else you may need to help finalize your design.



Applications (cont'd)

The following pictures will give some general ideas as to how the Winkel combined bearings and profiles are used. These are just a few examples and many more are available in our catalogs and web-sites. Please call PTI for additional detail.



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