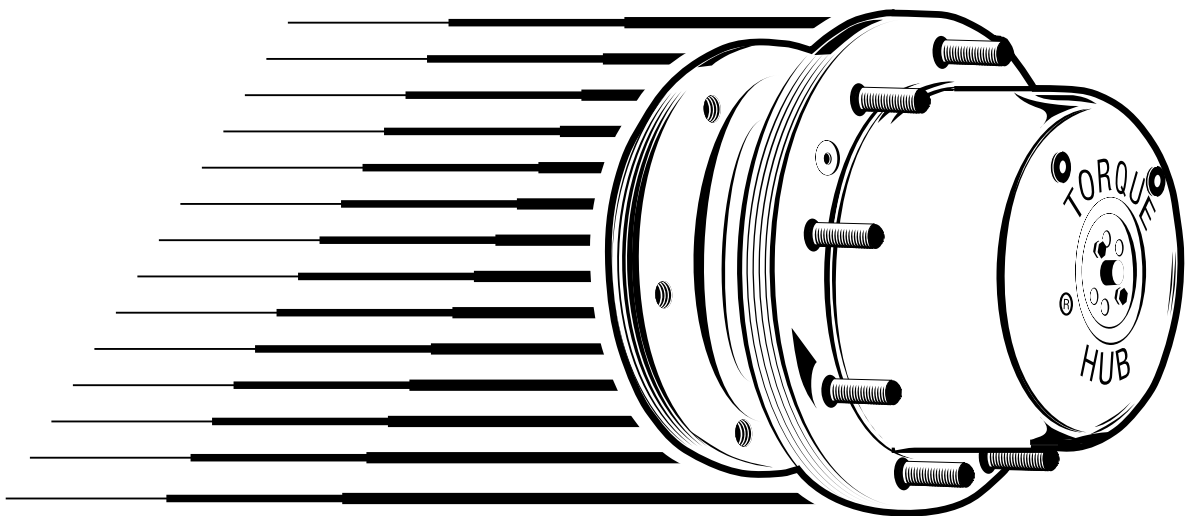


Ratings and Performance Guide

FAIRFIELD

GEARED FOR EXCELLENCE



TORQUE-HUB®

PLANETARY FINAL DRIVES

About This Guide...

This guide to Fairfield Torque-Hub® drive ratings and technical issues has been created to help you in selecting the proper Fairfield product for your application, as well as address the frequent questions that arise pertaining to available product options, features, and service issues. Our standard Torque-Hub® drives are available with maximum output torque ratings from 12,000 in-lbs up to 4,000,000 in-lbs, with ratios from 3:1 to more than 1,100:1.

The Fairfield approach to drive system applications centers around the belief that thorough “front-end” application engineering practices, field testing and in-depth communication with our customers and their designers, we’ll provide you with the best drive system. We pay particular attention to gear and bearing life, and feel that it is extremely important that our customers know how we obtain our product ratings. It is our belief that the information in this guide will provide you with a better understanding of how we rate and apply our products to *fully* meet your drive needs.

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NOTE: This catalog was complete and correct at the time of printing for the specific Torque-Hub products designated at the time of its printing. However, Fairfield Manufacturing Co., Inc. reserves the right to update and improve its products at any time. All specifications are therefore subject to change without notice.

Torque-Hub® Product Lubrication Specification

General Properties

The lubricant used in all Torque-Hub® drives should be a petroleum based, non-detergent gear fluid containing antioxidation, antifoaming and extreme pressure additives. The lubricant should have a minimum viscosity index of 95 cst and maintain a minimum viscosity of 40 cst under normal operating temperature conditions.

The following table lists the recommended viscosities for various ambient operating temperatures. These recommendations are based on a temperature rise of 50° to 100° F at normal operating conditions.

Maintenance

Oil mounts for each series of Torque-Hub® drives are indicated in the appropriate series literature. An initial oil change should be made after the first 50 hours of operation. Subsequent oil changes should

be made at 1000 hour intervals or annually, whichever comes first.

Oil temperature should be no higher than 160° to 180° for continuous operation, and no higher than 200° F for intermittent operation. For special applications, high horsepower, high speeds or wide temperature changes, please consult Fairfield Manufacturing.

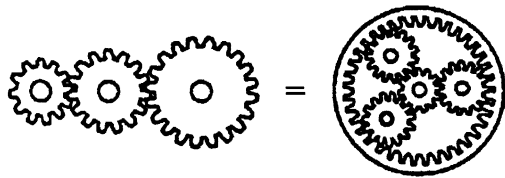
Oil Fill Level

When the Torque-Hub® unit is mounted horizontally, the gearbox should be filled half-full of oil. Consult the appropriate series literature for approximate fill volumes. Vertically mounted Torque-Hub® units may require special lubrication procedures. Please contact Fairfield Manufacturing for vertically mounted applications.

		Differential Planetaries		Simple Planetaries	
Ambient Temperature	ISO Index	AGMA Lubricant Number	ISO Index	AGMA Lubricant Number	
-40x to -5x F ⁽¹⁾	VG100	3EP	VG100	3EP	
-5x to 40x F	VG150	4EP	VG100	3EP	
40x to 105x F	VG220/VG320	5EP/6EP	VG150/VG220	4EP/5EP	
105x to 150x F ⁽²⁾	VG460	7EP	VG320	6EP	
<p>Footnotes</p> <ol style="list-style-type: none"> For operation in this ambient temperature range a synthetic oil or multi-grade oil is recommended with a pour point of 10° F lower than the minimum ambient temperature. For operation in this ambient temperature range a synthetic oil is recommended for proper lubricant life at elevated temperatures. 					

Gear Basics

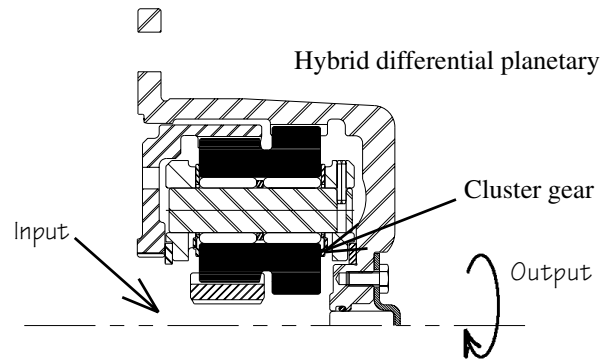
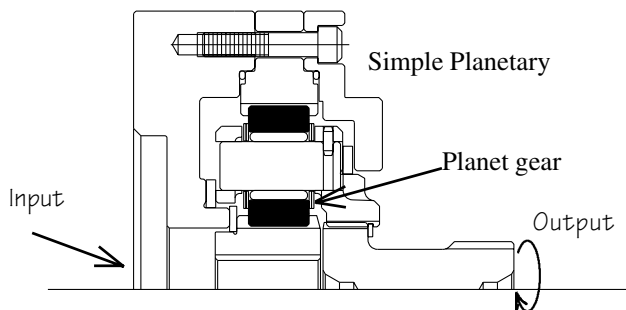
Gears come in many sizes and shapes. Their teeth may be straight or curved, and run parallel or inclined to the axis of rotation. They are connected together in many different ways (usually within a housing) to transmit motion and torque. Even with all the different combinations possible, their actions are quite similar. If one gear rotates, it will move any gear meshed with it in the opposite direction. A difference in speed between two gears produces a change in the amount of torque transmitted.



In-line gear set versus planetary gear set

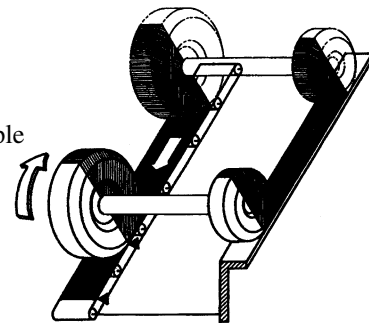
The simplest spur gear set consists of two gears meshed together in the same plane (an in-line gear set). If both gears are the same size, they will rotate at the same speed and torque, but in opposite directions. When running gears in increasing sizes, the input torque is multiplied, reducing the speed. The output torque is proportionate to the combined ratios of all the gears in the gear set multiplied by the input torque. Torque-Hub® products use these basic principles in both the simple planetary and hybrid differential models.

The **Simple Planetary Gear Set** is defined as a sun (input) gear and planet gears, positioned by a carrier, and a ring gear. Compared to an in-line gear set, a planetary gear set provides torque multiplication in a smaller, more compact mounting package. However, the maximum ratio attainable from a single, simple planetary stage is 7.5:1. By stacking, or coupling, more than one simple planetary gear set together inside one final drive, higher reduction ratios are achieved.



Fairfield's **Hybrid Differential Planetary Gear Set** consists of a sun (input) gear, three cluster (planet) gears and two internal (ring) gears. The dotted line in the diagram above shows how torque flows through the input gear driving the cluster gears. The cluster gears then react off a fixed ring gear, causing output torque to flow to a second ring gear. The unique feature of a Fairfield hybrid differential planetary is the clustered planet gear. Each clustered planet gear consists of two gears with different diameters clustered together on the same shaft. This allows higher ratios in a shorter package when compared to simple planetary gear sets. The example below illustrates the mechanics of differential gear sets.

Cluster gear example



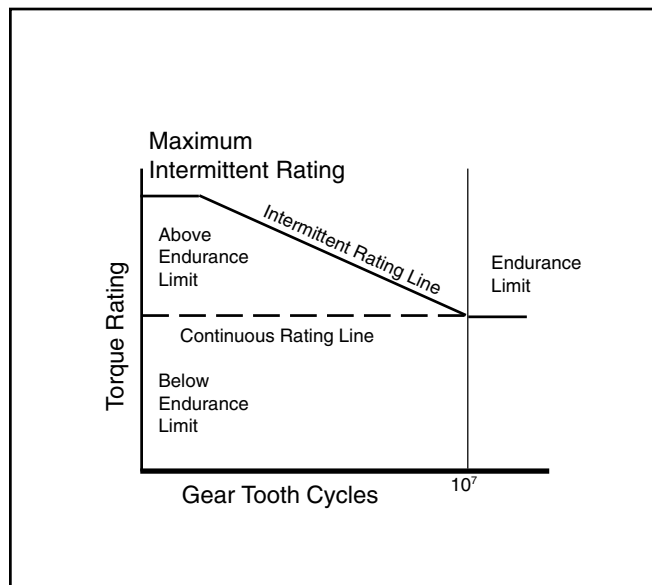
In this example, two wheels of different diameters are connected. The wheels represent the cluster gear. The smaller wheel is on a fixed track, while the larger wheel is on a movable track. The movable track represents the ring gear which drives the output member (hub). The fixed track represents the internal gear, which is the reaction member. After half a revolution, the movable track slides back a distance equal to one-half the difference in the circumferences of the two wheels. Differential gear sets differ from simple planetaries because their ratio is achieved by the difference in circumference between the large gear and the small gear on the planetary cluster.

Definition of Ratings

Continuous Rating - The continuous rating of a Torque-Hub® product is based upon the endurance limit of the gear material and heat treatment selected for the gears. By definition, the endurance limit means that Torque-Hub® products, operated at or below the continuous torque output rating, should not experience gear tooth breakage. Torque-Hub® product life will then be determined by bearing and seal wear, structural stresses, or thermodynamic considerations.

Intermittent Rating - Operation of the Torque-Hub® product above the continuous rating will result in gear tooth bending stresses above the endurance limit. Therefore, gear tooth breakage will occur in a finite number of cycles. Please reference the Sn curve, shown below, for a visual explanation.

Sn curve



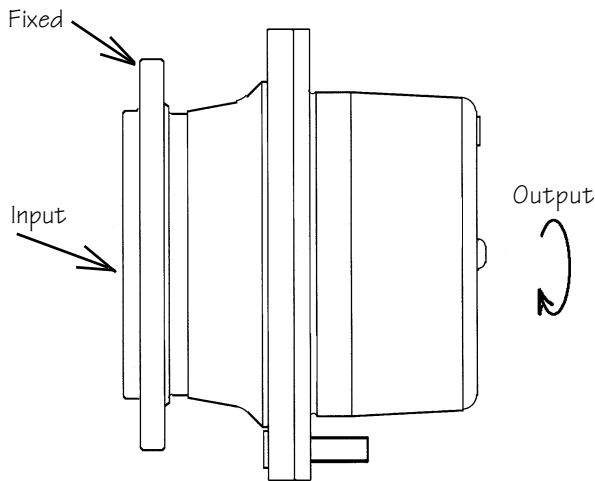
The maximum intermittent torque ratings listed for Torque-Hub® products represent structural limits for safe operation. Gear stresses at this level are still below the yield point for the material. Spindle shafts, hubs, and bolted connections have been designed to operate at their endurance value at the maximum intermittent torque rating.

Peak Rating - The peak rating for a Torque-Hub® product is the maximum one-time torsional load the Torque-Hub® unit can be subjected to without failure. However, this rating should be considered as a worst case or shock load only, and should not be considered as a part of the normal duty cycle.

Horsepower Capacity - High horsepower applications are defined as applications requiring continuous high speed and high torque. The horsepower capacity of each Torque-Hub® drive is based on thermodynamic capacity of the unit and the heat dissipation characteristics of its installation. The location of a Torque-Hub® drive in your installation greatly effects the steady state temperature value of that unit. For example, if a Torque-Hub® drive is located inside a drum or other closed cavity, then the resulting internal temperature will be higher than a Torque-Hub® unit located on an open wheel because of the lack of air flowing over the unit. In general, mobile applications experience a wide range of horsepower levels throughout a normal duty cycle. This is true of non-drawbar type vehicles such as spray tractors, combines, lift trucks, etc. Average horsepower throughout the duty cycle for these types of machines is usually acceptable if the unit is properly sized for torque and speed.

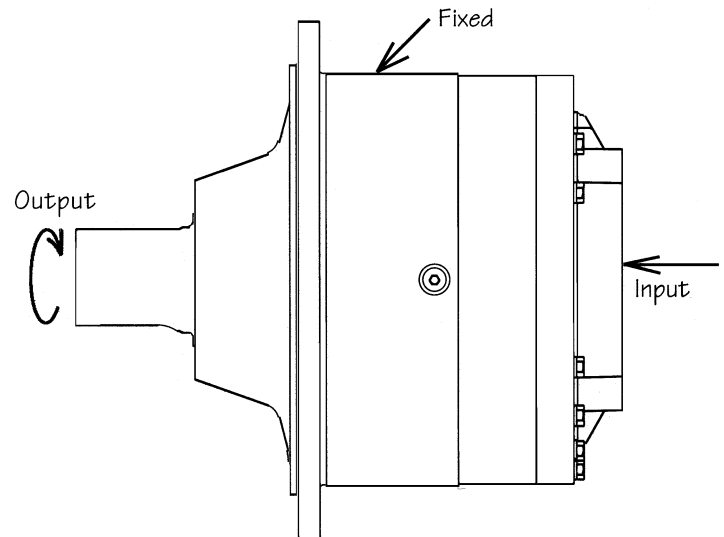
In contrast, drawbar type vehicles and industrial type applications often see long periods of continuous duty. This can result in higher continuous horsepower levels than normally experienced in mobile applications. In this case, the horsepower requirement by itself may dictate the size of the Torque-Hub® unit, rather than the torque output requirement. Forced cooling may be necessary to meet the thermal dissipation requirements of the gearbox in severe applications. Please contact a Fairfield representative for horsepower guidelines and suggestions when applying Torque-Hub® drives in high horsepower applications.

Product Configurations and Applications

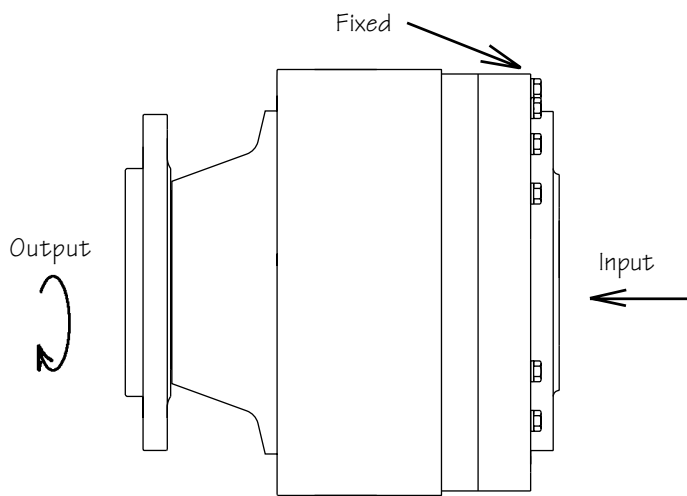


Wheel Drive Output

Torque-Hub® Shaft Output Drives can be applied to industrial applications such as conveyors, mixers, and augers. Shaft output Torque-Hub® units also meet power requirements for mobile equipment such as swing drives on access platforms, cranes, elevators and logging equipment. Our largest Torque-Hub® unit, the S200A shaft output, has a continuous rating of more than two million inch-pounds. It is used to raise and lower the legs of marine jack-up boats.



Shaft Output



Spindle Output

For applications requiring flange mounts, **Torque-Hub® Spindle Output Drives** offer design flexibility to meet your size restrictions. Spindle output units are used to power small lift trucks, mowers and scissor lifts. Any vehicle with small diameter drive wheels is a perfect candidate for spindle output Torque-Hub® unit.

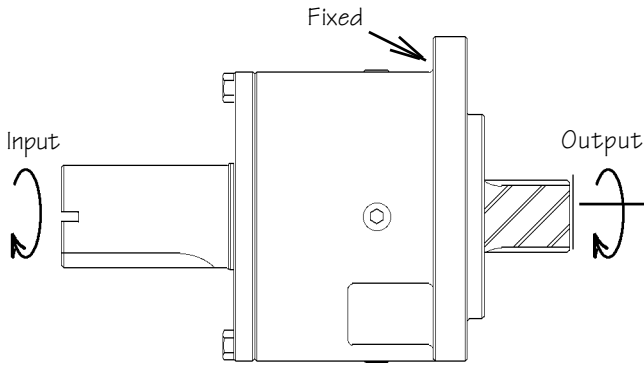
Product Information Chart

Series	Outputs Available	Ratios Available (x:1)	Planetary Type	Continuous Torque Rating (in-lbs x 1,000)	Intermittent Torque Rating (in-lbs x 1,000)	Max. Speed (x 1,000 rpm)
07	whd,sho,spo	4,12	Simple	7.5	15	5
1	sho	3-6	Simple	15	30	5
1	whd,sho,spo	18-68	Differential	15	30	4
2	whd,sho,spo	13-49	Differential	25	50	4
DW2	whd	18-61	Simple	22.5	45	4
EW1	whd	18-61	Simple	15	30	4
MW3	whd	10-110	Simple	30	60	5
3	whd,sho,spo	18-87	Differential	37.5	75	4
4	whd	12-37	Simple	40	80	5.5
5	whd	15-49	Simple	50	100	4
6	sho	4-6	Simple	60	120	3
6	whd, sho, spo	13-42	Simple	60	120	5
7	whd,sho,spo	26-94	Differential	75	150	3
8	whd	50	Simple	80	160	5
9T	whd	35	Simple-2 Speed	90	250	3.75
10	whd,sho,spo	43-123	Differential	125	250	2
R11	whd	46,57	Compound/Simple	110	220	4
12	whd,sho,spo	20-40	Simple	125	250	4
12T	whd	20,29,40	Simple-2 Speed	125	250	3.75
16	whd,sho,spo	20-40	Simple	160	320	4
16T	whd	20,29,40	Simple-2 Speed	160	320	3.75
20	whd,sho,spo	26-115	Differential	250	500	2
25	whd,sho,spo	19-25	Simple	200	400	3
50	whd,sho,spo	18-40	Simple	500	1,000	3
90	whd,spo	25	Simple	1,200	2,000	2
200	sho	1176	Hybrid	2,000	c/f	2
T2B	sho	3.46-4.09	Simple	6	c/f	3.75
T2A	sho	3.46-4.09	Simple	6	c/f	4
G07	sho	3.6	Simple	6	c/f	4
IA15	sho	1	Input Adapter	15	c/f	3.6
RA7	sho	1	Straight Bevel	3.7	c/f	3.4
RA708	sho	1.53	Straight Bevel	1.2	c/f	3.4
RA10	sho	2.78	Straight Bevel	3.7	c/f	3.4
Series	Outputs Available	Ratios Available (x:1)	Planetary Type	Continuous Torque Rating (Nm x 1,000)	Intermittent Torque Rating (Nm x 1,000)	Max. Speed (x 1,000 rpm)
CW12	whd	18-51	Simple	6	12	units with brake - 5
CW18	whd	26-51	Simple	9	18	
CT18	whd	63-136	Simple	9	18	units without brake - 6
CT26	whd	51-202	Simple	13	26	
CT35	whd	63-136	Simple	17.5	35	
CT45	whd	63-136	Simple	22.5	45	
<div style="border: 1px solid black; padding: 5px;"> <p>Key whd = wheel hub drive sho = shaft output spo = spindle output c/f = contact Fairfield</p> </div>						

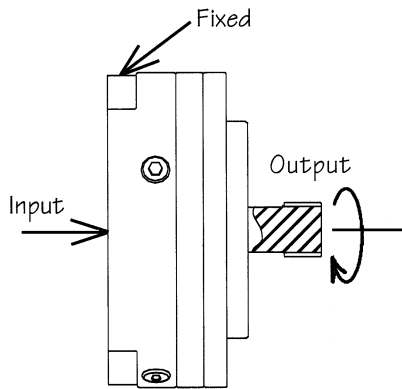
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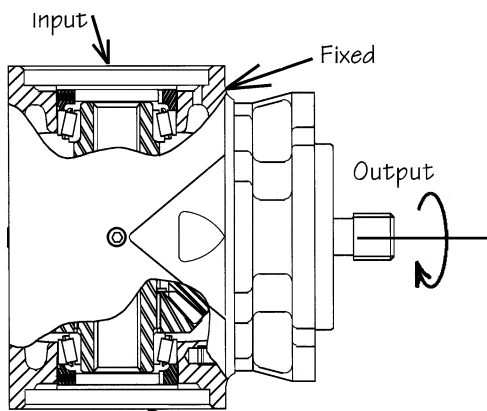
Input Adapters



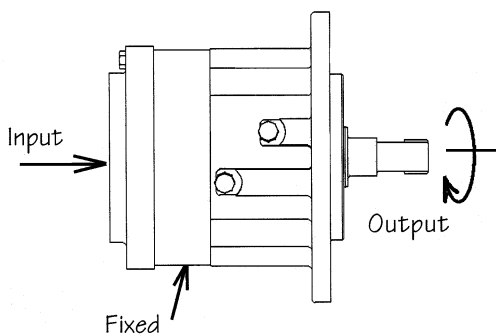
Inline Adapter



G07



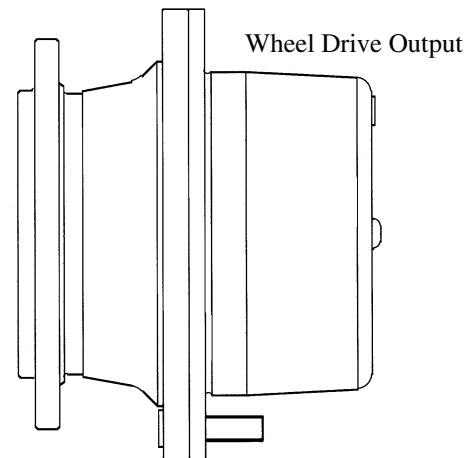
Right-Angle Input Adapter



T2A

The **Inline Adapter** series is the simplest of the input adapters. The straight keyed input shaft makes it possible for virtually any rotating member, such as PTO shaft inputs or pulleys, to drive the Torque-Hub®. Its large common shaft is supported in a rugged housing by two heavy duty bearings. This allows for large multiple row belts and larger centerline offsets than most commercially available overhung load adapters.

The **G07** “gearhead” increases the input torque by 3.6 and reduces the output speed by the same ratio. This makes it possible to increase the reduction of an existing machine or add reduction for a new design, while still using a standard Torque-Hub®. Its oil is shared with the primary Torque-Hub® model, but may be accessed from the G07 housing.



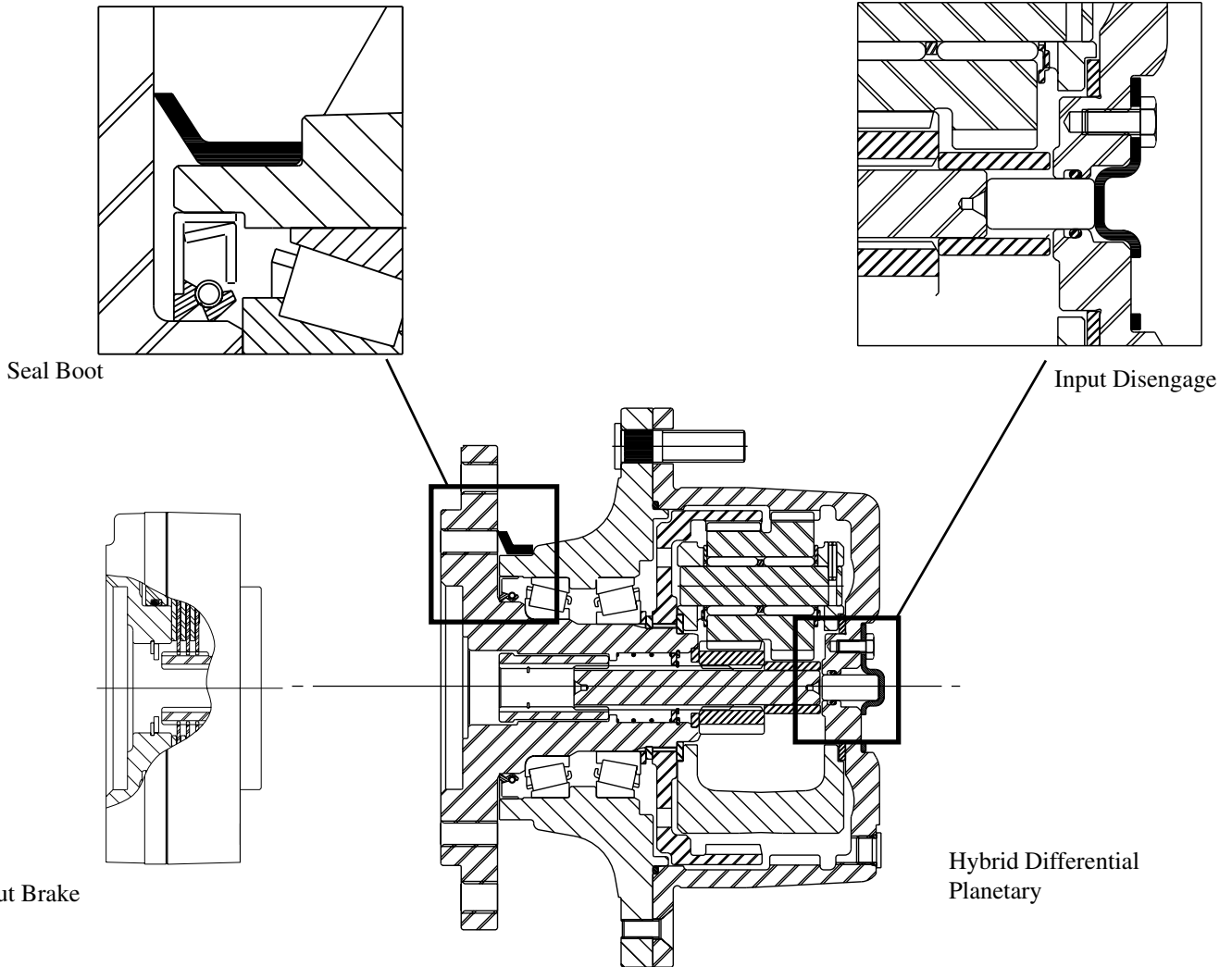
The **Right-Angle** series makes it possible to drive a Torque-Hub® from 90° to its centerline. This keeps the overall length shorter than an inline drive. The dual inputs on either side of the housing make it possible to use multiple drives or add a brake. Ports are available for speed sensors. The RA oil may be shared with the primary Torque-Hub® or sealed from it.

The **Two Speed (T2A)** series can make any Torque-Hub® a two speed transmission. The ratio range is 1:1 and 3.56 or 4.09:1. The T2A is shifted by hydraulic or pneumatic pressure. Ratio changes are achieved by a unique, patented Fairfield shifter that can shift while moving but not under load. The result is a very economical way to create a two speed axle.

Options

The **Seal Boot** is a supplementary seal that helps protect the main oil seal from dirt and debris encountered in the operating environment, thus extending the life of your equipment. The seal is lubricated by injecting grease through a Zerk fitting (not provided) on the motor mount.

The **Input Disengage** feature is standard on most Torque-Hub® wheel drives. When the disengagement cap is removed and reversed, the Torque-Hub® gear package is disconnected from the motor so that the machine may be towed. Towing speeds, however, cannot exceed the maximum speed rating for the unit (Please reference product information chart for maximum speed information).

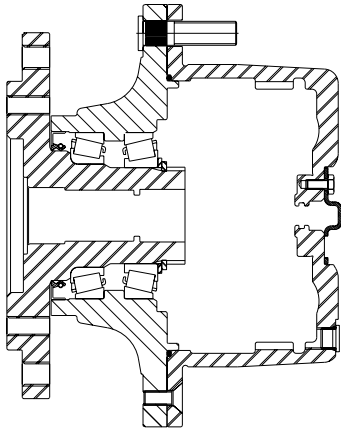


Input Brakes are available for almost every Torque-Hub® product. They come in two basic styles, a bolt-on extra like the “pancake” brake, shown above, or as a fully integrated brake like the CT/CW series. These brakes are to be used as parking brakes only. Dynamic braking is not allowed under normal operating conditions. Please consult our applications engineering personnel for further information.

Dynamic (service) brakes can be applied to Torque-Hub® products in the form of some wet types of pancake brakes, disc/caliper brakes and by conventional drum brakes on certain Torque-Hub® models. Ask your Fairfield representative for ideas and information about adding dynamic braking to your Torque-Hub® application.

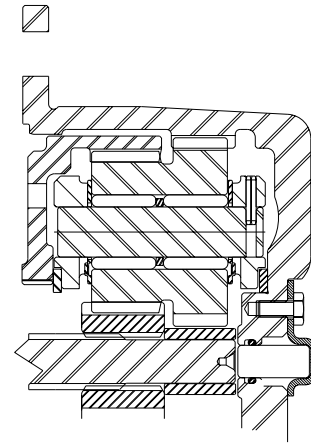
Kits

A **Bearing Support Kit** usually contains all the non-drive parts of a Torque-Hub® unit. They are very useful where load support is needed, but no drive is required. The reason why the bearing support kit is more economical than custom-made parts is due to the fact that they contain standard Torque-Hub® parts which are manufactured in large quantities.



Bearing Support Kit

Where space or design limitations preclude the use of a Torque-Hub® unit, a **Gear Kit** allows the designer to retain the torque and ratio capabilities of the Torque-Hub® product while meeting other design criteria. The standard gear kit contains a ring gear, carrier package, input gear, input coupling and shaft, and a cover. Many combinations exist to meet your specific torque and speed requirements.



Gear Kit

Torque-Hub® Mobile Application Warranty Policy

Fairfield Manufacturing Company, Inc., warrants all products manufactured to be free from defects in material and workmanship, for a period of (12) months from the date of product is put into service, or (18) months from date of shipment from our factory, whichever comes first.

Fairfield Manufacturing Company, Inc., may elect to repair or replace, at its discretion, any product that it deems defective, based on inspection and examination of the returned goods.

This warranty is in lieu of all other warranties, either implied or expressed, and all other obligations or liabilities, including damages resulting directly or indirectly due to said defects. Fairfield Manufacturing Company, Inc., neither assumes nor authorizes any person or company to assume liability on the company's behalf, in connection with the sale of our products.

This warranty does not cover any labor charges for replacement of parts, adjustments, repairs, or any other work done in connection with the use of Fairfield products.

This warranty does not apply to any product which has been repaired or altered by a source other than Fairfield Manufacturing Company, Inc., in such a way, that in our judgement, affects the products stability or proper operational characteristics. In addition, this warranty does not apply to products, found by Fairfield, to be have been subjected to misuse, negligence, or accidental damages. In addition, this warranty does not apply to the application of products manufactured by Fairfield Manufacturing Co., Inc.