

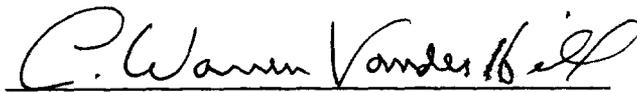
Study of the Market for Power Take-Offs

An Honors Thesis (ID 499)

By

Katherine R. Boulis

Thesis Director



C. Warren Vander Hill
C. Warren Vander Hill

Ball State University

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OBJECTIVES OF THE STUDY

The power take-off market was studied to determine opportunities for product development in this market and to obtain the following information:

1. What are the major market applications?
2. Who are the major competitors in the power take-off market?
3. What is the pricing structure of the market?
4. What is the current power take-off market size?
5. What are the major factors involved in the purchase decision?

CONDUCT OF THE STUDY

Personal or telephone interviews were conducted with the following respondents:

	<u>Number of Persons/Firms</u>
Competing PTO Manufacturers and Distributors	5/3
Diesel Engine Manufacturers, Prospective Customers	28/15
Diesel Engine Distributors, Prospective Customers	12/12
Pump Drive Manufacturers	<u>7/ 7</u>
Total Contacts	52/37

Requests for sales literature were made to over 100 diesel engine manufacturers. Telephone interviews were then made with selected manufacturers (Appendix A).

Two personal visits were made by John Miller, Merle Coy, and Kathy Boulis to two prospective customers.

Telephone interviews with competitors were made by Kathy Boulis as a student from Ball State University performing a research assignment and as a market analyst from Warner Gear.

PRODUCT DESCRIPTION

The basic function provided by the PTO is to transmit power from an engine to an implement via mechanical and hydrostatic means while providing the ability to selectively disengage the power. This is essentially the function served by a clutch in mobile vehicles.

COMPETITION

Total sales for the 1981 power take-off market were \$18 million. Twin Disc and Rockford Division account for approximately 90% of all power take-off sales. The only other competitors are captive manufacturers. Minneapolis-Moline buys clutches for their power take-offs from Twin Disc, while Caterpillar manufactures their own units.

It is generally felt that Twin Disc is the leading competitor, but very little product differentiation exists between Rockford and Twin Disc. It appears that the Rockford and Twin Disc product line are interchangeable and the primary purchase determinants are dependent upon price, availability, and the number of models required to satisfy a broad range of market requirements which translate into inventory costs.

COMPETITON (Continued)TWIN DISC, INC.

Twin Disc power take-offs can be used for either side-load or in-line drive applications. Twin Disc manufactures power take-offs with clutches from single plate 6-1/2" to 14", double plate 11-1/2" to 18", and triple plate 14" to 21". They can be used for front or flywheel mount applications. The Twin Disc distribution network consists of 25 large distributors in the United States, four sales offices, and an inside sales force. Major customers of Twin Disc for power take-off sales are Arrow Speciality, Caterpillar Tractor, Cummins Engines, Detroit Diesel, and Waukesha Engines. A Twin Disc source feels that these customers prefer Twin Disc power take-offs because of the serviceability, quality, and low failure rates (as low as .5%). Their products are well engineered, and they have been in the business for 35 to 40 years. "Between you and me, Rockford's units in the smaller range are identical to ours, absolutely identical. I almost couldn't tell the difference."

Their total PTO sales for 1981 were approximately \$10 million. From sources at Twin Disc, most Twin Disc PTO sales are in those units smaller than 18" clutch models. They divulged that \$2.5 million were received in sales from the 6-1/2" to the 10" clutch PTO's.

COMPETITION (Continued)ROCKFORD DIVISION

Rockford manufactures PTO's with taper roller bearings for side-load applications and with ball bearings for in-line drives. They are available with clutch sizes from single plate 6-1/2" to 14", double plate 8" to 18", and triple plate 14" to 21". They are sold through 52 distributors and an inside sales force. Major customers of Rockford Division are Deere, Detroit Diesel, and Ford Industrial Engines. A Rockford source feels that these customers prefer their products because of price and availability. The 1981 Rockford power take-off sales were \$8 million (Appendix B).

COMPETITION (Continued)PRODUCT COMPARISONS

There are many advantages to our power take-off design over a Rockford or Twin Disc, the latter two of which are essentially the same. Our PTO has five wet clutches and the ability to fit seven as opposed to having dry clutches. The self-adjusting clutch plates and the pressure lube system, respectively, help to reduce maintenance and sustain the life of the clutches. Twin Disc and Rockford PTO's are engaged by a hand lever at the side of the PTO. Our PTO uses a solenoid which lends remote accessibility.

Competitor's PTO's are offered in clutch sizes of 6-1/2", 7-1/2", 8", 10", 11-1/2", 14", 18", and 21". Our power take-off model can accommodate the amounts of torque handled by the 6-1/2", 7-1/2", 8", 10", and 11-1/2" clutches. This greatly reduces inventory requirements. The Warner Gear PTO can obtain static torque ratings of up to 340 lb-ft. We have a well-designed and versatile power take-off.

MAJOR MARKET SEGMENTS

From oil fields to agricultural fields, from cranes to highway salt spreaders, from rock crushers to forestry chippers, power take-offs are used in a diversity of applications. We have classified five major market segments for power take-offs: marine, agriculture, oil fields, industrial and off-highway vehicles, and on-road vehicles.

Oil Field:

Power take-offs are presently used to power pumps or generators for oil exploration and oil well production. With the accelerated search for new oil and the expansion of present oil fields, the requirements for power take-offs in this industry should continue their upward climb.

Marine:

In the marine market, fishing boats and workboats use power take-offs to drive auxiliary lines, pumps, winches, and other fishing and deck machinery. There is an unsatisfied need in this market for a power take-off that is packaged in a small envelope, remotely actuated and priced competitively. According to a Warner Gear distributor, prospective customers are currently improvising their PTO need with Warner Gear Series 71 marine transmissions.

MAJOR MARKET SEGMENTS (Continued)

Agriculture:

Irrigation systems, pumps, and drum mixers are some of the possible applications for power take-offs in the agricultural market. With the ever-increasing need for food production and interest in irrigation systems, power take-off sales should be affected positively.

Industrial and Off-Highway Vehicles:

Industrial uses for power take-offs include chippers for use in rock quarries, mining equipment, saw mills, fire pumps, and drum mixers. Off-highway vehicles using PTO's are forklift trucks, cranes, graders, pavers, and power shovels. Since power take-offs can be used on almost anything that has a mechanical drive, the high level of sales in this industry should continue.

On-Road Vehicles:

Crankshaft-mounted power take-offs are used on salt spreader trucks and refuse packer trucks. The PTO's presently in use are awkward to engage or disengage while the trucks are in motion. There is an unfilled need according to Muncie Power Products for a more easily disengageable power take-off in on-road vehicles.

SIZE OF MARKET

Rockford and Twin Disc power take-off sales totaled \$18 million in 1981. This information was supplied by direct sources at Twin Disc and Rockford. This does not include captive in-house production by Caterpillar and Minneapolis-Moline. Estimated market size in the recession year 1981 is \$20 million.

The purchasing information supplied by firms contacted was used as a reliable sample (Appendix C) to estimate market size in units for Rockford and Twin Disc. Estimated market size in the recession year 1981 is 33,000 power take-off units.

1981 Sales--Power Take-Offs

	<u>Units</u>	<u>Dollars (000,000)</u>
Twin Disc	17,420	\$10
Rockford Division	14,280	8
Other	<u>1,300</u>	<u>2</u>
Total	<u>33,000</u>	<u>\$20</u>

SIZE OF MARKET (Continued)

Competitors Estimated Unit Sales Volume by Clutch Size--1981
(Based on Prices Charged to Distributors)

<u>Clutch Size</u>	<u>Rockford</u>	<u>Twin Disc</u>	<u>Total</u>	<u>Distribution %</u>
6 1/2"	70	80	150	1
7 1/2"	2,690	3,200	5,890	18
8"	880	1,240	2,120	7
10"	7,830	9,600	17,430	55
11 1/2"	2,430	2,790	5,220	16
14"	<u>380</u>	<u>510</u>	<u>890</u>	<u>3</u>
Totals	14,280	17,420	31,700	100%

NATURE OF THE PURCHASE DECISION

The purchase decision for power take-offs actually involves a number of different decisions. It is necessary to determine the following: the kind of engine that will be used, gas or diesel, and the size of the engine, horsepower and RPM's; the amount of torque to be handled by the clutch; whether the clutch will be engaged for long or short periods, and whether it will be engaged for continuous or intermittent operations; the amount of slippage when the clutch is engaged, and the frequency of reversals of load on the output shaft. Other factors of importance are the price, availability, customer specifications, and maintenance.

STRENGTHS/WEAKNESSES

Strengths: The power take-off market is attractive to Warner Gear for a number of reasons.

1. The power take-off that we have designed has many features making it superior to competitors. With one model, the Warner Gear PTO can handle applications presently requiring a 6 1/2", 7 1/2", 8", 10", or 11 1/2" model. This is quite a cost reduction in carrying costs for prospective customers. Because the clutches are saturated with oil, they will wear much longer than standard dry clutches. The pressure lube system and self-adjusting clutches greatly simplify and reduce the cost of maintenance. The Warner Gear power take-off is remotely actuated providing for a wider and more flexible range of applications.
2. Muncie Power Products, the initiator of our interest in this market, has agreed to share tooling costs with Warner Gear. They have a need for four to five thousand units a year for the on-road vehicle market segment. Muncie Power has an excellent distribution network, so this is a real plus to have them working with us.

STRENGTHS/WEAKNESSES (Continued)

3. We currently have underutilized facilities at the Auburn plant. They have the capabilities to handle the manufacturing of the power take-off. By entering this market, we will be giving them considerable business.
4. There are many parts in the power take-off that are common with Muncie components. It would only be necessary for Warner Gear to purchase approximately five parts in order to manufacture the power take-off.

Weaknesses: There are two main weaknesses that Warner Gear has in entering the power take-off market.

1. This is a new market for Warner Gear. This, in itself, is a risk for any business. Warner Gear would have to be willing to devote time and personnel to this new area of business in order to make it successful.
2. Warner Gear does not have an established distribution network. There must be a way to get the product to the customer. This is a very important obstacle which needs to be removed.

CONCLUSIONS AND RECOMMENDATIONS

To summarize the findings on power take-offs:

1. The total power take-off industry in the U.S. totaled an estimated \$20 million, 33,000 units, in the recession year 1981. Twin Disc lead the industry with \$10 million in sales, an estimated 17,000 units. Rockford Divison was in second place with \$8 million in sales, an estimated 14,000 units. Captive manufacturers such as Minneapolis Moline, picked up the slack.
2. Twin Disc has models ranging from a 6-1/2" clutch to a 21" clutch with single, double, or triple plates. Rockford has models in the same varieties as Twin Disc, but they also offer side-load and straight-load models. Our one model will be able to act as a substitute for any of the 6 1/2" to 11" models.
3. Major markets for power take-offs are agriculture, industrial and off-highway vehicles, oilfields, on-road vehicles, and marine.
4. The Warner Gear power take-off has five wet clutches with an option for seven. It has a pressure lube system which reduces maintenance and promotes durability. One model can accommodate wide varieties of torque up to 340 lb-ft.

CONCLUSIONS AND RECOMMENDATIONS (Continued)

5. After technical questions are answered concerning applications, the nature of the purchase decision rests on availability, customer specifications, maintenance, and price. Price is apparently the attention-getting, overriding factor.

We plan to concentrate on pumping applications in the oil field, agricultural (irrigation), and on-road vehicle markets. We will also be able to concentrate on marine applications.

Our distribution network for pumping applications in the oil field, agricultural, and on-road vehicle markets will be through major OEM's, such as Ford Industrial Engines, Detroit Diesel Allison, Caterpillar, and Arrow Specialty Company. For marine applications, we will be able to utilize our marine distributors.

Our pricing structure must be noticeably competitive with Twin Disc and Rockford since this is what will gain most attention. Presently, distributors receive approximately a 30% discount from list prices, while OEM's are given approximately a 43% discount. Based on the pricing information we have gathered (see Appendix D), we plan to be similar in price with the 6 1/2", 7 1/2", and 8" models but very competitive as we move towards the 10" and 11 1/2" models.

APPENDIX ACONTACT RESPONSESArrow Specialty Company, Tulsa, OK

Twin Disc is standard on all engines we sell, and we sold 6,500 engines in 1981, mostly to be used in oil fields. Our largest selling unit uses the 10" clutch PTO. The majority of our sales come from Oklahoma and Texas.

Caterpillar Tractor, Peoria, IL

We use some Twin Disc PTO's, some Rockford PTO's, and we design some of our own. We use them mainly for fishing boat applications. We sell better than 1,000 a year of the 8" single plate clutch and the 11" PTO.

Cummins Sales & Service (Perkins Distributor), Arlington, TX

We use Twin Disc 7-1/2", 10", and 11". We sell about 500 a year for application with pumps, irrigation wells, etc. You name it, we can put a PTO on it. We buy Twin Disc over Rockford, because Rockford offers side-load and straight-load making it necessary to carry more in stock.

Cummins Sales & Service (Perkins Distributor), Houston, TX

We use less than 50 a year of Twin Disc 7-1/2" clutch PTO.

Deere, Moline, IL

We use Rockford power take-off from 10" to 14" for applications on irrigation wells, saw mills, fire pumps, and drum mixers. We sell through distributors, so we don't know what our distributors buy direct. We sell directly about 1,200 a year of the 10" power take-off.

Delta Irrigation Company (Perkins Distributor), Memphis, TN

We sell mostly to farmers for irrigation systems. We do business with the smallest farmer to the largest contractor. We sell Rockford PTO's--approximately 100 to 200 last year. We would like to see a pamphlet when you have more information. I am definitely interested, especially if it's cheaper.

Detroit Diesel, Detroit, MI

We sell directly about 1,000 PTO's a year from either Twin Disc or Rockford. Many are handled through our distributors, but I don't

know how many. We use the 8" single plate and the 11-1/2" single and double plate front-mounted PTO's for marine applications. For example, they may be used to drive a pump. We also use the 10" PTO for rear-mounted applications.

Deutz, Atlanta, GA

We use Rockford and Twin Disc. In the past, we used them mainly for irrigation applications. We no longer buy them direct, but our distributors do sell them. We use the 6-1/2", 8", 10", and 11-1/2".

Diesel America, Inc. (Deutz Distributor), El Paso, TX

We are a Rockford distributor. Yearly we use about 15 of the 10" and about 50 of the 6-1/2" PTO's for irrigation applications.

Fairbanks-Morse, Rosco, IL

We manufacture about 1,000 engines for oil field applications. We don't use a power take-off or a clutch with the bell housing, but we mount an over-center clutch on the crankshaft. We receive a lot of complaints about these and would be very interested in talking with you.

Federal Gear Safeguard, Kendallville, IL

We buy 1,500 Twin Disc power take-offs of the 11-1/2" single or double plate clutch. These are used strictly for industrial applications, such as on pavers, graders, cranes, power shovels, lumbering equipment, and mining equipment.

Ford Industrial Engines, Detroit, MI

We sell directly to our distributors 4,000-5,000 8", 10", and 11 1/2" Rockford PTO's per year for applications on chippers and pump drives. We especially like the care-free maintenance your design offers. We feel that it is this feature that will sell it. The biggest market for PTO's is irrigation, even though the chipper market is a good one. You could also sell it for use in trenchers; it would have to have large enough bearings to handle the load.

Funk Manufacturing, Coffeyville, KA

We do not use PTO's with a dry clutch. We buy about 3,000 units a year from Twin Disc or Rockford, according to availability, but we have the dry clutch replaced with a torque converter.

General Diesel Sales & Service, Blue Grass, IA

We use about 200 a year of the 10" or 11-1/2" Twin Disc power take-offs, which we sell to construction equipment OEM's. We have just begun handling a Kabota engine which will range from 10-80 HP for industrial applications, and we need a power take-off for it.

International Harvester, Melrose Park, IL

We used to use Rockford or Twin Disc 7-1/2" to 14", three plate model PTO's for various industrial applications, including irrigation pumps. I would like to know if you make any new innovations.

Marco, Seattle, WA

We use dry clutches with the Twin Disc power take-off for use in boats in the fishing and oil industries. We use the 11-1/2" and 14" clutch size models, but I don't know how many.

Midwestern Power Products Co., (Perkins Distributor), Des Moines, IA

We sell about 25 a year of the Rockford 10" or 11-1/2" clutch PTO's. Twin Disc is too highly priced. We use them in agricultural applications for irrigation and standby units. I would like some literature when you get some.

Minneapolis Moline, Russellville, AK

We buy clutches from Twin Disc but manufacture the PTO ourselves. We make the 14" double plate PTO, but we don't make more than 200 a year. I see an increasing need in the future for power take-offs for farm irrigation systems and for oil field pump jacks.

NC Moline, (Perkins Distributor), Seattle, WA

We sell the 7-1/2" and the 11-1/2" for the smaller Perkins engines. They are mainly used for pump drives. We sell about ten power take-offs a year from either Twin Disc or Rockford.

Northern Diesel Company (Deutz), Seattle, WA

We use about 25 Twin Disc power take-offs a year from 6-1/2" to 18" for attachments to the rear of engines. They are used for mining gold or uranium, underwater pumping units, and irrigation systems.

Northern Lights Diesel Systems, Seattle, WA

We use the Twin Disc 6-1/2" clutch PTO. We usually put one on about every fourth generator set we sell with a Luger engine. I'd estimate that we sell over 100 PTO's a year.

Perkins Engines, Wayne, MI

We sell less than 500 power take-offs a year, either Rockford or Twin Disc. We use the 7-1/2" and the 11-1/2" clutch models. Some of our distributors are also Rockford or Twin Disc distributors, so I don't have any idea of what they're selling.

Waukesha Engines, Waukesha, WI

We use Twin Disc power take-offs in the 7-1/2", 10", 11", and 14" clutch models. We use about 1,000 a year for applications in pumping, drilling, and irrigation systems. The 11-1/2" is used mainly for oil field pump jacks.

White Engines, Canton, OH

We use about 300 10" power take-offs a year from Twin Disc or Rockford, depending upon the availability, price, and customer specifications. They are used for irrigation systems and pumps.

Appendix B

Rockford Unit Sales of 8" PTO--1980

197819791980

1922

1119

698

APPENDIX C

Sample of Power Takeoff Purchases by Clutch Size--1981

	<u>6-1/2"</u>	<u>7-1/2"</u>	<u>8"</u>	<u>10"</u>	<u>11-1/2"</u>	<u>14"</u>	<u>Total</u>
Arrow Specialty		1,300		3,575	650	975	6,500
Caterpillar			500		500		1,000
Cummins Sales & Svc.							
Arlington, Texas		170		170	170		510
Cummins S & S							
Houston, Texas		50					50
Deere				1,200			1,200
Delta Irrigation		50	50	50	50		200
Detroit Diesel			500		500		1,000
Diesel America, Inc.	50			15			65
Ford				4,500			4,500
General Diesel S & S				100	100		200
Midwestern Power Prods.				15	15		30
Federal Gear Safeguard					1,500		1,500
NC Marine		5			5		10
Northern Diesel	5		5		5		15
Perkins		250			250		500
Romine Industries				150			150
Waukesha		347		131	418	26	922
White				<u>300</u>			<u>300</u>
Total	55	2,172	1,055	10,206	4,163	1,001	18,652
Distribution %	.3	12	5.7	55	22	5	100

Appendix D

AVERAGE PRICES BY CLUTCH SIZES*

<u>Number of Clutch Plates</u>		<u>COMPANY</u>					
		<u>Rockford Division</u>			<u>Twin Disc</u>		
		<u>Single</u>	<u>Double</u>	<u>Triple</u>	<u>Single</u>	<u>Double</u>	<u>Triple</u>
<u>Clutch Size</u>							
6 1/2"	OEM	288			299		
	Dist	354			368		
	List	505			525		
7 1/2"	OEM	291			305		
	Dist.	357			375		
	List	510			535		
8"	OEM	421	2,727		374		
	Dist.	517	3,350		459		
	List	738	4,785		656		
10"	OEM	458			466		
	Dist.	562			573		
	List	803			818		
11 1/2"	OEM	591	751		644	923	
	Dist.	725	923		790	1,133	
	List	1,036	1,318		1,129	1,619	
14"	OEM	868	1,157	1,628	804	1,440	1,967
	Dist.	1,065	1,420	1,999	988	1,768	2,415
	List	1,522	2,029	2,856	1,411	2,526	3,450
18"	OEM		2,802			2,579	4,572
	Dist.		3,441			3,167	5,615
	List		4,915			4,524	8,021

*Compiled from price lists provided by a Twin Disc distributor, Cummins Kentuckiana, and Rockford Division.