

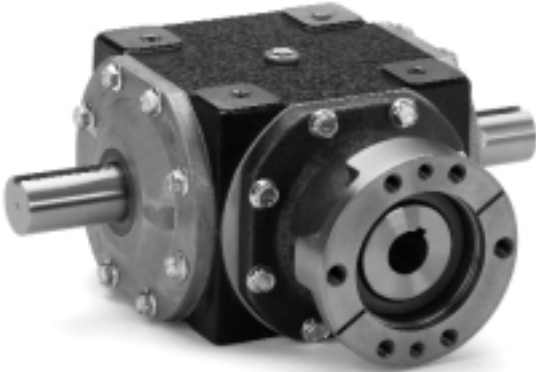
# Bevel Gear Boxes – Hydraulic Motor Driven Model 93 – REFERENCE SHEETS

Other Models Available. For Instant Data, see [www.vonruden.com](http://www.vonruden.com).

**NOTE: Model 113 can also be provided with an SAE C flange.**



07.08.03



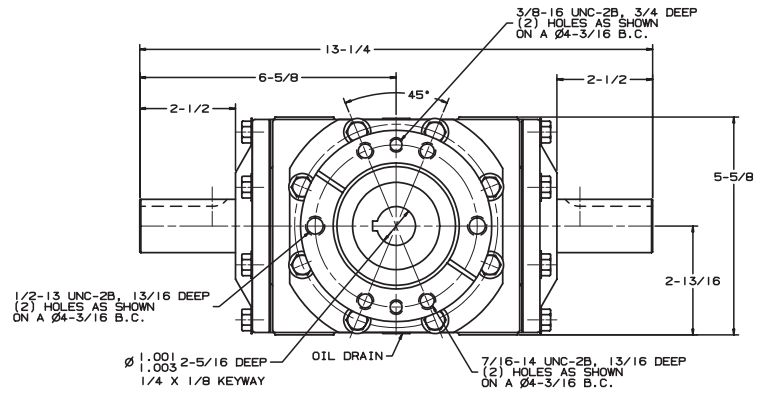
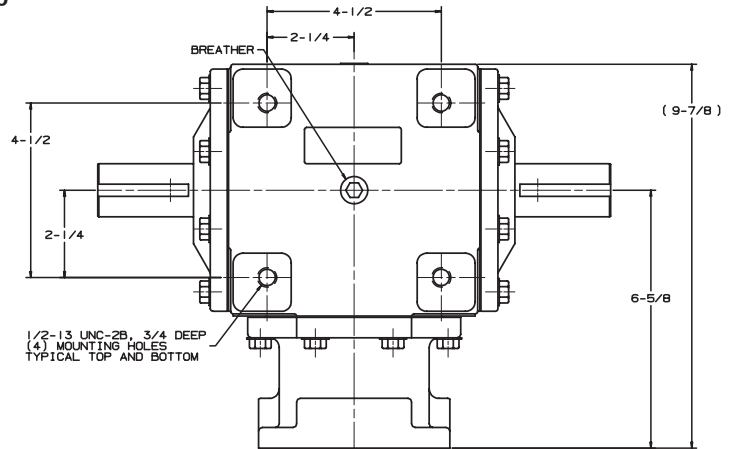
- Rugged Cast Iron housing.
- Weight = 43 lbs. (approx.)
- Oil Capacity = 40 oz. (approx.)

## HYDRAULIC MOTOR MOUNTING FLANGE

Combined on one flange  
SAE A 2-Bolt (3/8" bolts)  
SAE A 2-Bolt (1/2" bolts)  
Special 4-Bolt (Ross MAB)

## KEYWAYS

1.375 Dia. Cross Shafts	1.00/1.003 Dia Input Shaft (Female)
5/16" x 5/32"	1/4" x 1/8"
1-7/8" Full Depth	2-5/16" Deep



Model 93-2000 Shown Above

MODEL NUMBER	Gear Type & RATIO		TORQUE RATINGS (LB.-INCHES)							INTERMITTENT**
			CONTINUOUS*							
			10 RPM	100 RPM	300 RPM	540 RPM	700 RPM	1000 RPM	1750 RPM	
93-2000	Forged 1:1	Input	5181	5181	4003	3363	3110	2362	***	5181
		Output	5181	5181	4003	3363	3110	2362	***	5181
93-2001	Forged 1.35:1	Input	3856	3856	3059	2574	2372	2130	1804	3856
		Output	5206	5206	4130	3471	3202	2876	2435	5206
93-2002	Straight Cut 1.5:1	Input	2659	2659	2537	2127	2074	1768	1508	2659
		Output	3989	3989	3806	3191	3111	2652	2262	3989
93-2003	Straight Cut 2:1	Input	1353	1353	1353	1353	1353	1353	1241	1353
		Output	2700	2700	2700	2700	2700	2700	2482	2700
			INTERMITTENT HORSEPOWER RATINGS*							
			INPUT RPM							
93-2000	Forged 1:1		.82	8.2	24.6	44.4	57.5	82.2	***	
93-2001	Forged 1.35:1		.61	6.1	18.4	33.0	42.8	61.2	107.1	
93-2002	Straight Cut 1.5:1		.42	4.2	12.6	22.8	29.5	42.2	73.9	
93-2003	Straight Cut 2:1		.21	2.1	6.4	11.6	15.0	21.4	37.6	

\* Use gear strength ratings only. See rating explanation on Page 3.

\*\* Pitch line velocity is too fast for proper gear lubrication depending on duty cycle. See important installation and lubrication information on Page 4

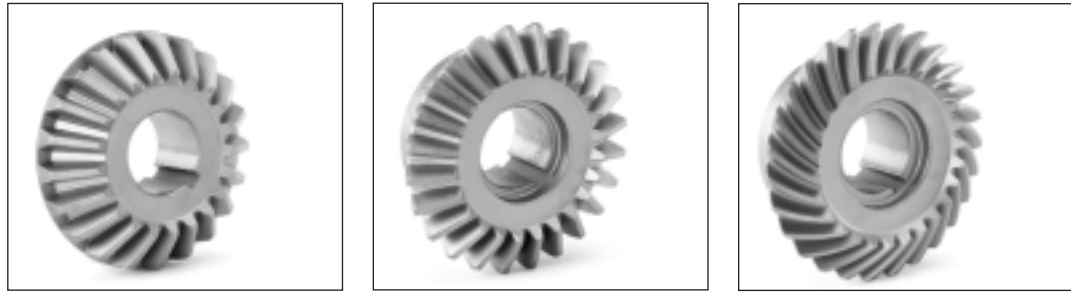
\*\*\*Consult Factory

# Bevel Gear Boxes – Hydraulic Motor Driven Model 93 – REFERENCE SHEETS

Other Models Available. For Instant Data, see [www.vonruden.com](http://www.vonruden.com).



07.08.03



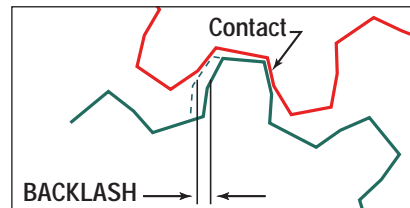
## Gear Types

	Precision Forged	Straight Cut	Spiral
<b>Horsepower</b>	Highest. Forging process yields stronger metal grain structure. Also, forged gears can be designed with a web connecting the heel of teeth for increased strength.	Lower than forged.	Higher than straight cut. More teeth in continuous contact and increased tooth beam strength. But the thrust load imposed by spiral gears reduces bearing life.
<b>Speed</b>	Same as straight cut.	Same as forged.	Highest, due to better lubrication and contact.
<b>Noise Level</b>	Good	Improved over forged.	Best, more continuous tooth contact.
<b>Cost/Gear (once tooled)</b>	Relatively Low.	Moderate But set-up costs greatly influence price, especially in quantities less than 100.	Highest due to the extra machining required. Also, set-up costs influence cost significantly, especially in quantities less than 100.
<b>Tooling Cost</b>	Very high. Plus long lead time for tooling (months).	Low. Primarily a gear cutter.	Low. Primarily a gear cutter.
<b>Economical Production Lot Size</b>	High (1000s).	Low. But cost is influenced significantly by set-up, especially for less than 100.	Low. But cost is influenced significantly by set-up, especially for less than 100.

## Backlash

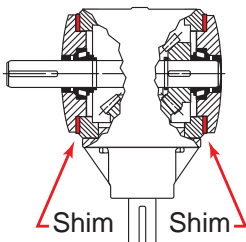
Our Standard backlash is 0.004" minimum and 0.012" to 0.015" maximum. Other backlash can be provided on a special order basis.

We shim our gear boxes for consistent backlash using the process described below.

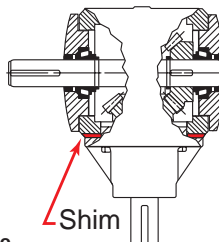


Backlash = The shortest distance between the non-contacting surfaces of adjacent gear teeth.

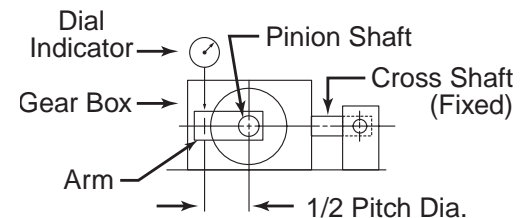
## Shimming Procedure



**STEP 1**  
Shim bearings on cross shaft to acceptable end play of .003" to .001"



**STEP 2**  
Shim pinion housing to achieve proper backlash and gear tooth contact



**STEP 3**  
Measure backlash

# Bevel Gear Boxes – Hydraulic Motor Driven Model 93 – REFERENCE SHEETS

Other Models Available. For Instant Data, see [www.vonruden.com](http://www.vonruden.com).



07.08.03

## Gear Box Ratings

Our strength and durability ratings are based on AGMA suggested guidelines, engineering calculations and our own actual experience. They should be used only as an initial selection guide.

We cannot guarantee that these ratings will prove satisfactory for all applications. Complete suitability can be determined only through prototyping and field testing.

## AGMA Ratings

AGMA Ratings apply to gear material, heat treatment, design, tooth finish, tooth profile, and allowable tolerances.

Our straight cut and spiral gears are manufactured to AGMA Class 9 with forged gears manufactured to AGMA Class 7. Other AGMA classes can be provided.

## Class of Service

Our ratings are based on AGMA Class 1 service conditions. A 1.00 service factor is used when the application is free from recurrent shock loading and is continuous but does not exceed 10 hours per day. For other operating conditions, the rated horsepower can be increased or decreased by dividing the rated horsepower by the proper service factor from this table.

Prime Mover	Duration of Service	DRIVEN MACHINE LOAD CLASSIFICATIONS		
		Uniform	Moderate Shock	Heavy Shock
Electric Motor	Occasional .5 hr/day	.0.50	.0.80	.1.25
	Intermittent 3 hrs/day	.0.80	.1.00	.1.50
	Up to 10 hrs/day	.1.00	.1.25	.1.75
	24 hrs per day	.1.25	.1.50	.2.00
Multi-Cylinder Internal Combustion Engine	Occasional .5 hr/day	.0.80	.1.00	.1.50
	Intermittent 3 hrs/day	.1.00	.1.25	.1.75
	Up to 10 hrs/day	.1.25	.1.50	.2.00
	24 hrs per day	.1.50	.1.75	.2.25
Single Cylinder Internal Combustion Engine	Occasional .5 hr/day	.1.00	.1.25	.1.75
	Intermittent 3 hrs/day	.1.25	.1.50	.2.00
	Up to 10 hrs/day	.1.50	.1.75	.2.25
	24 hrs/day	.1.75	.2.00	.2.50

## Our Catalog Rating System

RPM	→	700
<hr/>		
HP based on gear strength	→	57.5
<hr/>		
HP based on 1000 hours L <sub>10</sub> bearing life	→	41.6
<hr/>		
HP based on 5000 hours L <sub>10</sub> bearing life	→	25.7
<hr/>		

## Bearing Life Ratings

Our bearing life ratings are based on the L<sub>10</sub> life calculations which are an expression of reliability. There is a 90% reliability (100% less 10%) that the bearing life will equal or exceed the calculated hours listed.

We tabulate bearing ratings for both 1000 and 5000 hours of L<sub>10</sub> life.

Our calculations assume no externally applied thrust or radial loads. Bearing life can be calculated when external loads are applied, but our engineers need to know the location and direction of the external load as well as its magnitude. Use our application data sheet (DT176) when forwarding information.

## Torque Ratings

Horsepower ratings are provided in these reference section. To determine torque, use this calculation.

$$T = 63.025 \frac{HP}{N}$$

T = Torque (Lb.-inches)  
HP = Horsepower  
N = RPM

## Starting Torque

Momentary or starting torque should be limited to 200% of gear strength rated capacity.

## Maximum Speeds

The maximum speeds listed in our catalog can be exceeded in some applications. Consult factory.

All information is subject to change without notice. Always confirm with us that you are working with the most current data.

# Bevel Gear Boxes – Hydraulic Motor Driven Model 93 – REFERENCE SHEETS

Other Models Available. For Instant Data, see [www.vonruden.com](http://www.vonruden.com).



07.08.03

## Thermal Capacity

The thermal capacity of a gear box (Its ability to dissipate heat) may be somewhat less than the mechanical horsepower ratings included in this documentation. The thermal capacity is dependent on load conditions (duty cycle) and cooling air circulation.

Additional cooling or a larger gear box may be required if the continuous operating temperature exceeds 200°F.

Prototype testing is recommended.

## Lubrication Specifications

All Standard Bevel Boxes are splash lubricated and splash cooled. Shafts must be mounted horizontally (+/-15°). When shafts are mounted vertically, an external grease fitting may be required. Please specify when ordering.

The input speed rating must not exceed the gear box's specification. Maximum continuous operating temperature for standard units is 180° F (82° C). The maximum intermittent operating temperature should not exceed 225° F (107° C) with a rest period at least five times the running period. (Consult Factory on applications with operating parameters exceeding these requirements).

- All standard bevel boxes are **shipped without lubrication**. Box must be filled at least to the oil check plug before operating.
- The oil level should be established according to the gearbox's speed and mounting position.
- Boxes running below 500 RPM require a slightly higher oil level. In very low RPM applications the oil may be replaced with grease (Consult Factory).
- Overheating can be caused by too little or too much oil in the box.
- Use ISO VG150 EP antifoaming oil for normal operations. Use ISO VG100EP or ISO VG150EP antifoaming oil for high RPM applications.
- Fill, check and drain plugs are located for applications where all shafts are in a horizontal position, unless otherwise specified.
- Breather and drain plug positions meet most mounting requirements, however end users are responsible for relocating the breather and drain plugs to meet Von Ruden's specifications.
- Special units equipped with grease fittings should be serviced regularly with a multi-purpose NLGI Grade No. 2 grease.

## Approximate Oil Capacities

Models	15	25	27	33	40	90	93	110	113
Ounces (oz.)	4	8	6	16	16	24	32	56	80
Liters (L)	.1	.2	.15	.5	.5	.7	.9	1.7	2.4

## Recommended Lubricants

Ambient Temp.	Lubricant
-20° to 0° F	SAE 10W or 10W-40 Automotive Oil
0° to 40° F	SAE 80 Gear Oil with Anti-Foaming Agent
40° to 100° F	SAE 90 Gear Oil with Anti-Foaming Agent
100° to 150° F	SAE 140 Gear Oil with Anti-foaming Agent

## Lubrication Change Intervals

The lubricant in a new gear box should be changed after 100 hours of operation or four (4) weeks by draining at operating temperature, thoroughly cleaning with a flushing oil to remove any particles, and refilling with clean oil. Thereafter, under normal operating conditions, the lubricant should be changed every 2500 hours of operation or every six (6) months.

Under severe operating conditions such as dust or rapid temperature changes, the lubricant should be changed more frequently.

## Note

Von Ruden reminds users of these products that their safe operation depends on use in compliance with engineering information provided by Von Ruden Manufacturing. Users are also reminded that safe operation depends on proper installation, operation, and routine maintenance and inspection under prevailing conditions. It is the responsibility of users (and not Von Ruden) to provide and install guards or safety devices which may be required by recognized safety standards or by the Occupational Safety and health Act of 1970 and its subsequent provisions.