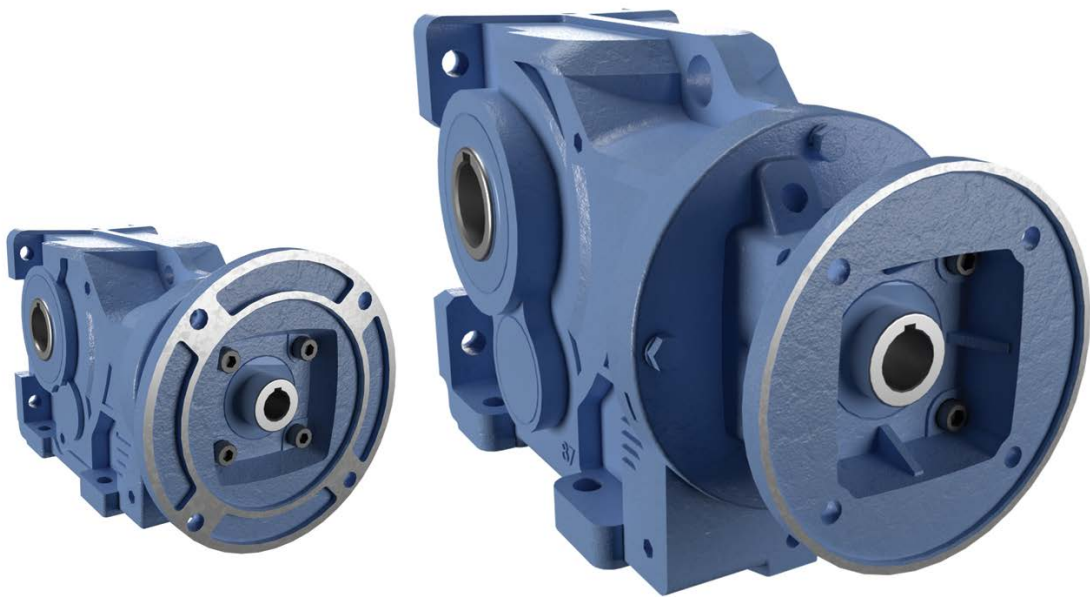


IRONHORSE[®] HELICAL BEVEL GEARBOX USER MANUAL

IH-HBR_UMW



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~ WARNING ~

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IRONHORSE® HELICAL BEVEL GEARBOX USER MANUAL



USER MANUAL REVISION HISTORY

Please include this Manual Number and the Manual Issue, both shown below, when communicating with AutomationDirect Technical Support regarding this publication.

MANUAL NUMBER: *IH-HBR_UMW*

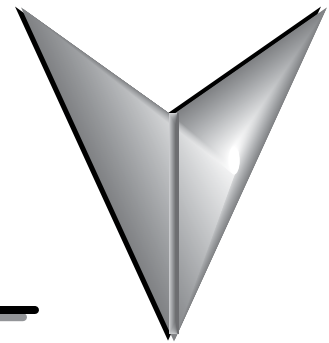
MANUAL ISSUE: *1ST Ed., REV A*

ISSUE DATE: *08/31/2022*

Publication History		
Issue	Date	Description of Changes
First Edition	10/03/2019	Original Issue
1st Ed., Rev A	08/31/2022	Ch. 2: Added Backlash data to Helical Bevel Gearboxes

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IRONHORSE® HELICAL BEVEL GEARBOX USER MANUAL TABLE OF CONTENTS



IronHorse® Helical Bevel Gearbox User Manual

WARNINGS AND TRADEMARKS	W-1
~ WARNING ~	W-1
Trademarks.	W-1
~ AVERTISSEMENT ~	W-2
Marques de commerce	W-2
USER MANUAL REVISION HISTORY	H-1
USER MANUAL TABLE OF CONTENTS	TOC-1
CHAPTER 1: GETTING STARTED	1-1
Manual Overview	1-2
IronHorse® Helical Bevel Gearbox Introduction	1-2
Part Number Explanation.	1-3
Nameplate Information.	1-3
CHAPTER 2: SPECIFICATIONS	2-1
IronHorse® Cast-Iron Helical Bevel Gearboxes.	2-2
Gearbox Selection Factors	2-2
IronHorse® Cast-Iron Helical Bevel Gearbox Specifications.	2-3
IronHorse® Cast-Iron Helical Bevel Gearbox Accessories	2-5
IronHorse® Cast-Iron Helical Bevel Gearbox Dimensions	2-6
CHAPTER 3: INSTALLATION, MAINTENANCE, AND LUBRICATION.	3-1
Safety Notification	3-2
Installation.	3-3
Mounting Positions	3-4
Startup Procedure.	3-4
Inspection and Maintenance.	3-4
Lubrication.	3-5
Seal Sizes.	3-7
Bearing Sizes.	3-7
Storage.	3-8
APPENDIX A: GLOSSARY OF TERMS	A-1
Glossary of Gearbox Terms.	A-2
APPENDIX B: GEARBOX SELECTION	B-1
Gearbox Selection Procedure	B-2
AGMA Service Factors.	B-5

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PAGE

GETTING STARTED



TABLE OF CONTENTS

Manual Overview	1-2
Overview of This Publication	1-2
Who Should Read This Manual.	1-2
Technical Support	1-2
Special Symbols	1-2
IronHorse® Helical Bevel Gearbox Introduction	1-2
Purpose of Helical Bevel Gearboxes	1-2
Package Contents	1-2
Part Number Explanation	1-3
Nameplate Information	1-3

MANUAL OVERVIEW

OVERVIEW OF THIS PUBLICATION

The IronHorse Helical Bevel Gearbox User Manual describes the installation, operation, and preventive maintenance of IronHorse Helical Bevel Gearboxes.

WHO SHOULD READ THIS MANUAL

This manual contains important information for people who will install, maintain, and/or operate any of the IronHorse Helical Bevel Gearboxes.

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SPECIAL SYMBOLS



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WHEN YOU SEE THE “EXCLAMATION MARK” ICON IN THE LEFT-HAND MARGIN, THE PARAGRAPH TO ITS IMMEDIATE RIGHT WILL BE A WARNING. THIS INFORMATION COULD PREVENT INJURY, LOSS OF PROPERTY, OR EVEN DEATH (IN EXTREME CASES).

IRONHORSE® HELICAL BEVEL GEARBOX INTRODUCTION

PURPOSE OF HELICAL BEVEL GEARBOXES

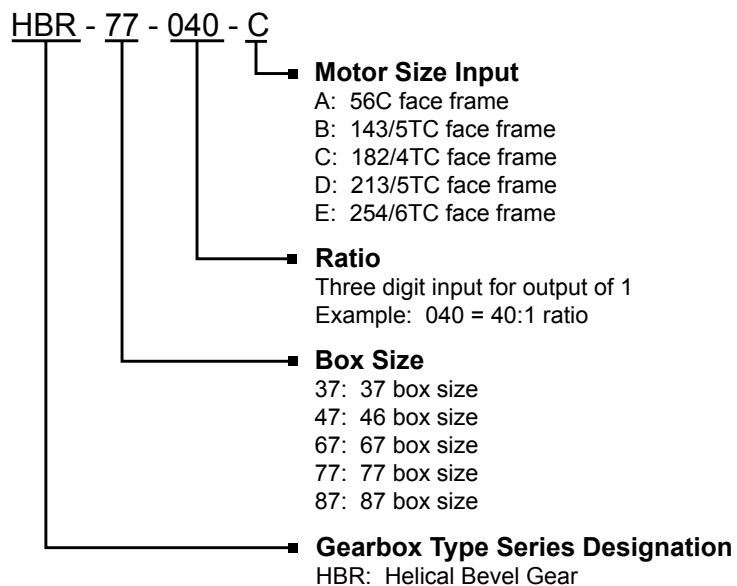
Gearboxes, also known as enclosed gear drives or speed reducers, are mechanical drive components that can control a load at a reduced fixed ratio of the motor speed. The output torque is also increased by the same ratio, while the horsepower remains the same (less efficiency losses). For example, a 10:1 ratio gearbox outputs approximately the same motor output horsepower, but motor speed is divided by 10 and motor torque is multiplied by 10. Helical bevel gearboxes use helical gears to provide quiet startup and smooth operation. IronHorse helical bevel gearboxes are manufactured in an ISO9001-certified plant by one of the leading and most internationally acclaimed gearbox manufacturers in the world today. Only the highest quality materials are tested, certified, and used in the manufacturing process. Strict adherence to and compliance with the toughest international and U.S. testing standards and manufacturing procedures assure you the highest quality products. We offer NEMA quill input, right-angle hollow-bore output Helical Bevel Gearboxes with cast-iron frames. The accessory output shafts are perpendicular to the input. These gearboxes utilize C-face and TC-face mounting interfaces for C-face and TC-face motors.

PACKAGE CONTENTS

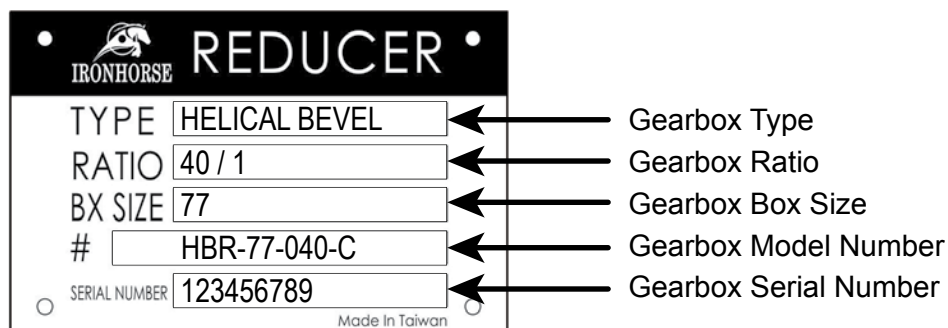
After receiving the IronHorse Helical Bevel Gearbox, please check for the following:

- Make sure the package includes the speed reducer and the vent plug.
- Inspect the unit to ensure that it was not damaged during shipment.
- Make sure that the part number on the gearbox nameplate is the same as the part number that you ordered.
- Gearboxes come prefilled with oil for an M1 mounting position. Check oil level and fill per instructions when changing to a different mounting position.

PART NUMBER EXPLANATION



NAMEPLATE INFORMATION



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PAGE

SPECIFICATIONS



CHAPTER

2

TABLE OF CONTENTS

IronHorse® Cast-Iron Helical Bevel Gearboxes2-2

Gearbox Selection Factors2-2

 Service Factors and K Factors. 2-2

IronHorse® Cast-Iron Helical Bevel Gearbox Specifications2-3

IronHorse® Cast-Iron Helical Bevel Gearbox Accessories2-5

 Output Shafts 2-5

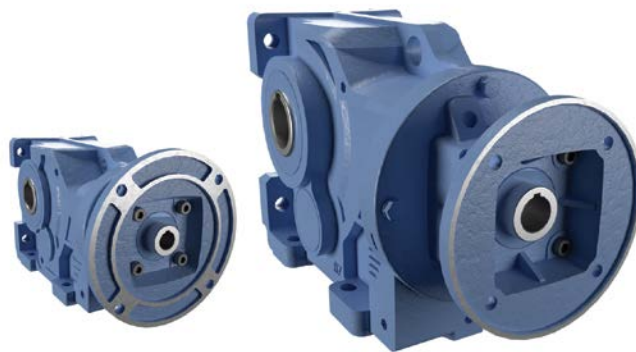
 Breather Plugs (Spare/Replacement). 2-5

IronHorse® Cast-Iron Helical Bevel Gearbox Dimensions2-6

 Gearbox Dimensions 2-6

 Gearbox Shaft Dimensions 2-6

IRONHORSE® CAST-IRON HELICAL BEVEL GEARBOXES



GEARBOX SELECTION FACTORS

SERVICE FACTORS AND K FACTORS

Service Factors* for Selecting Gearboxes (when used with electric motors)				
Service Continuity (per day)	Load Characteristics			
	Uniform	Moderate Shock**	Heavy Shock**	Extreme Shock**
Occasional 1/2 hour	1.00	1.00	1.00	1.25
Less than 3 hours	1.00	1.00	1.25	1.50
3-10 hours	1.00	1.25	1.50	1.75
More than 10 hours	1.25	1.50	1.75	2.00
<p>* Refer to the AGMA Service Factors section (page B-5) of the "Gearbox Selection" appendix for information regarding how to determine the appropriate service factor for your application.</p> <p>** Shock results from sudden increases in the torque demand of the load, such as: sudden stopping, restarting, and/or reversing; significantly heavy loads dropped onto a moving conveyor; impact loads such as punch press operations.</p> <p>Depending upon the load characteristics, divide the gearbox HP, Overhung Load, and Maximum Mechanical Capacity ratings by the applicable service factor.</p>				

Overhung Load K Factors for Various Drive Types	
Chain & Sprocket	1.00
Gear	1.25
V-belt	1.50
Flat Belt	2.50
Variable Pitch Belt	3.50
Divide gearbox OHL ratings by the applicable OHL K factors.	

IRONHORSE® CAST-IRON HELICAL BEVEL GEARBOX SPECIFICATIONS

IronHorse Cast-Iron Helical Bevel Gearbox Specifications												
Part Number	Box Size	Nominal Ratio	Actual Ratio	Output RPM @ 1750 RPM Input	NEMA Motor Frame**	Max Input Speed (rpm)	Max Input Power (hp) 1) 3)	Max Output Torque (lb-in) 3)	Max OHL (lbs) 2) 3)	Efficiency (%)	Backlash (Arc Minutes)	Approx Weight (lb)
HBR-37-010-A	37	10	11.09	158	56C	2,000	4.33	1,565	520	91	45	32
HBR-37-010-B		10	11.09	158	143/5TC		4.33	1,565	510			37
HBR-37-025-A		25	23.10	76	56C		2.20	1,659	635			32
HBR-37-025-B		25	23.10	76	143/5TC		2.20	1,659	610			37
HBR-37-040-A		40	37.97	46	56C		1.43	1,770	735			32
HBR-37-040-B		40	37.97	46	143TC		1.43	1,770	705			37
HBR-37-060-A		60	59.67	29	56C		0.91	1,770	815			32
HBR-47-010-A	47	10	9.95	176	56C	2,000	6.46	2,097	620	91	36	46
HBR-47-010-B		10	9.95	176	143/5TC		6.46	2,097	580			51
HBR-47-010-C		10	9.95	176	182/4TC		6.46	2,097	550			57
HBR-47-020-B		20	20.65	85	143/5TC		3.97	2,675	690			51
HBR-47-020-C		20	20.65	85	182TC		3.97	2,675	610			57
HBR-47-040-A		40	41.36	42	56C		2.50	3,372	945			46
HBR-47-040-B		40	41.36	42	143/5TC		2.50	3,372	905			51
HBR-47-060-A		60	58.99	30	56C		1.84	3,540	1030			46
HBR-47-060-B		60	58.99	30	143TC		1.84	3,540	980			51
HBR-47-085-A		85	86.89	20	56C		1.42	3,540	1110			46
HBR-67-010-B*	67	10	9.66	181	143/5TC	2,000	12.06	3,800	1500	91	33	73
HBR-67-010-C*		10	9.66	181	182/4TC		12.06	3,800	1410			80
HBR-67-020-B*		20	22.18	79	143/5TC		6.26	4,530	1760			73
HBR-67-020-C*		20	22.18	79	182/4TC		6.26	4,530	1570			80
HBR-67-040-A*		40	37.98	46	56C		4.62	5,730	2140			69
HBR-67-040-B*		40	37.98	46	143/5TC		4.62	5,730	2140			73
HBR-67-040-C*		40	37.98	46	182TC		4.62	5,730	1510			80
HBR-67-065-A*		65	64.97	27	56C		2.95	6,260	2140			69
HBR-67-065-B*		65	64.97	27	143/5TC		2.95	6,260	2140			73
HBR-67-085-A*		85	84.10	21	56C		2.46	6,760	2140			69
HBR-67-085-B*		85	84.10	21	143/5TC		2.46	6,760	2140			73
HBR-67-120-A*		120	118.14	15	56C		1.88	7,260	2140			69
HBR-67-120-B*		120	118.14	15	143TC		1.88	7,260	2140			73

* Due to size and/or weight restrictions, gearboxes HBR-67-xxx-x through HBR-87-xxx-x must ship via Freight.

** Although physical mounting to other motors is possible, please use only the motors as specified in this table.

1) Max Input Power is the highest HP 1800 rpm motor to be used with the gearbox under conditions of 1.0 service factor. Gearbox input power capacity decreases as motor speed decreases and as service factor increases.

2) OHL= Overhung Load ratings are for forces perpendicular to the output shaft and located at the shaft midpoint, such as from a gear, pulley, or sprocket with a belt or chain. Divide OHL ratings by the applicable OHL K factors shown separately in the Selection Factors tables. OHL ratings should also be divided by applicable service factors.

3) Maximum Mechanical Ratings are limits based on strength and durability of gearbox components; applicable when operating time is short and stopped time is greater than or equal to operating time. These ratings are applicable for 1.0 service factor loads, and may require modification depending upon characteristics of the applicable driven loads. Refer to the "Service Factors" table for more information.

(table continued next page)

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IronHorse Cast-Iron Helical Bevel Gearbox Specifications

Part Number	Box Size	Nominal Ratio	Actual Ratio	Output RPM @ 1750 RPM Input	NEMA Motor Frame**	Max Input Speed (rpm)	Max Input Power (hp) 1) 3)	Max Output Torque (lb-in) 3)	Max OHL (lbs) 2) 3)	Efficiency (%)	Backlash (Arc Minutes)	Approx Weight (lb)
<u>HBR-77-010-C*</u>	77	10	9.96	176	182/4TC	2,000	24.02	7,800	1860	91	29	132
<u>HBR-77-010-D*</u>		10	9.96	176	213/5TC		24.02	7,800	1690			148
<u>HBR-77-020-C*</u>		20	20.24	86	182/4TC		14.78	9,765	2080			132
<u>HBR-77-020-D*</u>		20	20.24	86	213/5TC		14.78	9,765	1740			148
<u>HBR-77-040-C*</u>		40	39.76	44	182/4TC		9.21	11,955	2050			132
<u>HBR-77-040-D*</u>		40	39.76	44	213TC		9.21	11,955	1390			148
<u>HBR-77-060-C*</u>		60	57.05	31	182/4TC		7.16	13,325	1860			132
<u>HBR-77-080-B*</u>		80	78.07	22	143/5TC		5.38	13,710	3080			128
<u>HBR-77-080-C*</u>		80	78.07	22	182TC		5.38	13,710	2570			132
<u>HBR-77-120-B*</u>		120	122.94	14	143TC		3.42	12,480	3090			128
<u>HBR-87-020-D*</u>	87	20	20.90	84	213/5TC	2,000	25.88	17,650	2780	91	25	230
<u>HBR-87-020-E*</u>		20	20.90	84	254/6TC		25.88	17,650	1940			257
<u>HBR-87-040-C*</u>		40	43.31	40	182/4TC		14.76	20,870	3450			208
<u>HBR-87-040-D*</u>		40	43.31	40	213/5TC		14.76	20,870	2930			230
<u>HBR-87-060-C*</u>		60	61.42	28	182/4TC		11.11	22,270	3510			208
<u>HBR-87-060-D*</u>		60	61.42	28	213/5TC		11.11	22,270	2780			230
<u>HBR-87-080-C*</u>		80	82.86	21	182/4TC		8.72	23,570	4260			208
<u>HBR-87-120-C*</u>		120	117.56	15	182TC		6.23	23,900	4370			208

* Due to size and/or weight restrictions, gearboxes HBR-67-xxx-x through HBR-87-xxx-x must ship via Freight.

** Although physical mounting to other motors is possible, please use only the motors as specified in this table.

1) Max Input Power is the highest HP 1800 rpm motor to be used with the gearbox under conditions of 1.0 service factor. Gearbox input power capacity decreases as motor speed decreases and as service factor increases.

2) OHL= Overhung Load ratings are for forces perpendicular to the output shaft and located at the shaft midpoint, such as from a gear, pulley, or sprocket with a belt or chain. Divide OHL ratings by the applicable OHL K factors shown separately in the Selection Factors tables. OHL ratings should also be divided by applicable service factors.

3) Maximum Mechanical Ratings are limits based on strength and durability of gearbox components; applicable when operating time is short and stopped time is greater than or equal to operating time. These ratings are applicable for 1.0 service factor loads, and may require modification depending upon characteristics of the applicable driven loads. Refer to the "Service Factors" table for more information.

IRONHORSE® CAST-IRON HELICAL BEVEL GEARBOX ACCESSORIES

OUTPUT SHAFTS



Single Output Shaft (typical)



Double Output Shaft (typical)

IronHorse Cast-Iron Helical Bevel Gearbox Output Shafts		
Part Number	Description	For Use With:
HBR-37-DS	IronHorse double output shaft, 1.000in. For use with HBR-37 series gearboxes. (4) keys, (1) spacer and (1) retaining ring included.	HBR-37-xx
HBR-37-S	IronHorse single output shaft, 1.000in. For use with HBR-37 series gearboxes. (3) keys, (1) end plate, (1) lock washer and (1) bolt included.	
HBR-47-DS	IronHorse double output shaft, 1.250in. For use with HBR-47 series gearboxes. (4) keys, (1) spacer and (1) retaining ring included.	HBR-47-xx
HBR-47-S	IronHorse single output shaft, 1.250in. For use with HBR-47 series gearboxes. (3) keys, (1) end plate, (1) lock washer and (1) bolt included.	
HBR-67-DS	IronHorse double output shaft, 1.500in. For use with HBR-67 series gearboxes. (4) keys, (1) spacer and (1) retaining ring included.	HBR-67-xx
HBR-67-S	IronHorse single output shaft, 1.500in. For use with HBR-67 series gearboxes. (3) keys, (1) end plate, (1) lock washer and (1) bolt included.	
HBR-77-DS	IronHorse double output shaft, 2.000in. For use with HBR-77 series gearboxes. (4) keys, (1) spacer and (1) retaining ring included.	HBR-77-xx
HBR-77-S	IronHorse single output shaft, 2.000in. For use with HBR-77 series gearboxes. (3) keys, (1) end plate, (1) lock washer and (1) bolt included.	
HBR-87-DS	IronHorse double output shaft, 2.375in. For use with HBR-87 series gearboxes. (4) keys, (1) spacer and (1) retaining ring included.	HBR-87-xx
HBR-87-S	IronHorse single output shaft, 2.375in. For use with HBR-87 series gearboxes. (3) keys, (1) end plate, (1) lock washer and (1) bolt included.	

BREATHER PLUGS (SPARE/REPLACEMENT)



Breather Plug (typical)

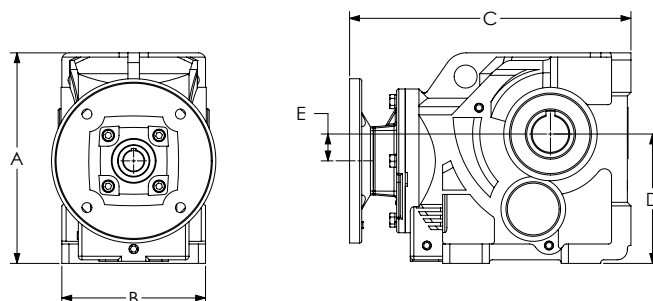
IronHorse Cast-Iron Helical Bevel Gearbox Breather Plugs *		
Part Number	Description	For Use With:
HBR-3777V	IronHorse breather plug, replacement. For use with size 37 through 77 HGR- and HBR-series gearboxes.	HB(G)R-37-xx through HB(G)R-77-xx
HBR-8797V	IronHorse breather plug, replacement. For use with size 87 and larger HGR- and HBR-series gearboxes.	HB(G)R-87-xx

* These items are included with the gearboxes, and are also available separately as spare or replacement parts.

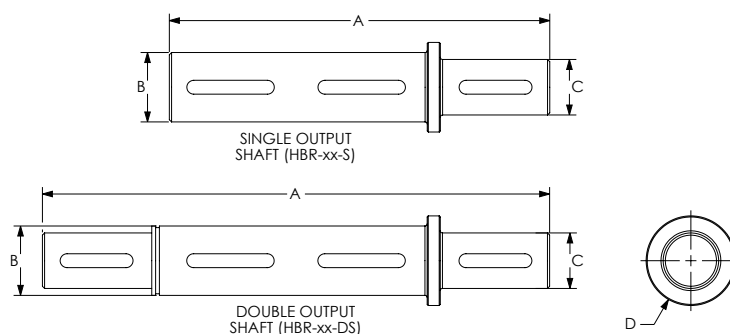
IRONHORSE® CAST-IRON HELICAL BEVEL GEARBOX DIMENSIONS

See our website www.AutomationDirect.com for complete Engineering drawings.

Dimensions = inches [mm]

GEARBOX DIMENSIONS

IronHorse Cast-Iron Helical Bevel Gearboxes						
Part Number	Frame	A	B	C	D	E
HBR-37-xxx-A	56C	6.46 [164.1]	4.72 [119.9]	10.35 [262.9]	3.94 [100.1]	0.31 [7.9]
HBR-47-xxx-A		7.32 [185.9]	5.91 [150.1]	11.56 [293.6]	4.41 [112.0]	0.20 [5.1]
HBR-67-xxx-A		8.98 [228.1]	7.09 [180.1]	12.42 [315.5]	5.51 [140.0]	0.75 [19.1]
HBR-37-xxx-B	143/5TC	6.46 [164.1]	4.72 [119.9]	10.75 [273.1]	3.94 [100.1]	0.31 [7.9]
HBR-47-xxx-B		7.32 [185.9]	5.91 [150.1]	11.95 [303.5]	4.41 [112.0]	0.20 [5.1]
HBR-67-xxx-B		8.98 [228.1]	7.09 [180.1]	13.13 [333.5]	5.51 [140.0]	0.75 [19.1]
HBR-77-xxx-B		11.54 [293.1]	8.27 [210.1]	14.69 [373.1]	7.09 [180.1]	1.47 [37.3]
HBR-47-xxx-C	182/4TC	7.32 [185.9]	5.91 [150.1]	12.68 [322.1]	4.41 [112.0]	0.20 [5.1]
HBR-67-xxx-C		8.98 [228.1]	7.09 [180.1]	13.86 [352.0]	5.51 [140.0]	0.75 [19.1]
HBR-77-xxx-C		11.54 [293.1]	8.27 [210.1]	15.41 [391.4]	7.09 [180.1]	1.47 [37.3]
HBR-87-xxx-C		13.39 [340.1]	9.45 [240.0]	17.99 [456.9]	8.35 [212.1]	1.24 [31.5]
HBR-77-xxx-D	213/5TC	11.54 [293.1]	8.27 [210.1]	17.68 [449.1]	7.09 [180.1]	1.47 [37.3]
HBR-87-xxx-D		13.39 [340.1]	9.45 [240.0]	20.26 [514.6]	8.35 [212.1]	1.24 [31.5]
HBR-87-xxx-E	254/6TC	13.39 [340.1]	9.45 [240.0]	21.24 [539.5]	8.35 [212.1]	1.24 [31.5]

GEARBOX SHAFT DIMENSIONS

IronHorse Cast-Iron Helical Bevel Gearbox Shafts				
Part Number	A	B	C	D
HBR-37-DS	9.14 [232.1]	Ø 1.25 [31.8]	Ø 1.00 [25.4]	Ø 1.61 [41.0]
HBR-37-S	6.85 [174.0]			
HBR-47-DS	11.10 [281.9]	Ø 1.38 [34.9]	Ø 1.25 [31.8]	Ø 1.73 [44.0]
HBR-47-S	8.42 [213.9]			
HBR-67-DS	13.94 [354.0]	Ø 1.50 [38.1]	Ø 1.50 [38.1]	Ø 1.89 [48.0]
HBR-67-S	10.43 [265.0]			
HBR-77-DS	16.78 [426.2]	Ø 2.00 [50.8]	Ø 2.00 [50.8]	Ø 2.40 [61.0]
HBR-77-S	12.44 [316.1]			
HBR-87-DS	19.52 [495.8]	Ø 2.38 [60.3]	Ø 2.38 [60.3]	Ø 2.80 [71.0]
HBR-87-S	14.41 [365.9]			

INSTALLATION, MAINTENANCE, AND LUBRICATION



TABLE OF CONTENTS

<i>Safety Notification</i>3-2
<i>Installation</i>3-3
<i>Mounting Positions</i>3-4
<i>Startup Procedure</i>3-4
<i>Inspection and Maintenance</i>3-4
<i>Lubrication</i>3-5
<i>Lubricant Selection and Volume</i>	3-5
<i>Lubricant Plug Locations & Fill Instructions</i>	3-6
<i>Recommended Lubricant: CPC E.P. LUBRICANT HD</i>	3-6
<i>Seal Sizes</i>3-7
<i>Bearing Sizes</i>3-7
<i>Storage</i>3-8

SAFETY NOTIFICATION

Please read this entire manual before the assembly or operation of this helical gearbox to make sure all safety considerations have been exercised and that care and concern for persons and equipment have been fully understood.

- 1) Failure to adhere to the instructions in this operating manual may result in severe or fatal injuries. During the operation of this unit, please take all necessary actions to protect personnel from all moving, rotating, and high temperature sections to avoid harm to personnel. There is a risk of burns caused by hot surfaces when this product is in use. Use properly rated protective gear when working with these products.
- 2) Only qualified personnel should transport, store, install, assemble, connect, start-up, operate and maintain this unit.
- 3) When you receive the helical bevel gearbox, please check the outside packaging first. If damage is apparent from shipping and transportation, please refuse shipment from the carrier and contact AutomationDirect customer service immediately for unit replacement. Never install and operate damaged products.
- 4) Before lifting, please make sure the lifting equipment for this unit is properly rated for the weight load of this equipment.
- 5) Use the unit only for its intended purpose.
- 6) Never operate the unit without the necessary protective covers or housing firmly in place.

INSTALLATION



NOTE: *Improper installation will cause damage to the speed reducer. Please read and familiarize yourself with every step of these installation instructions before beginning the installation process.*

- 1) Before installation, please check the input horsepower and ratio and verify that they match the ratings on the punched nameplate of the gearbox.
- 2) Clean all dirt from the surface of the flange before installation. During cleaning, be careful not to get cleaning solvents on any seals as cleaning solvents may damage the seals and void product limited warranty.
- 3) This gearbox can be mounted in any of six install positions (M1, M2, M3, M4, M5, M6). Positions M5 and M6 require an oil fill baffle plate, which is preinstalled by the factory and will not affect mounting positions M1–M4. See “Mounting Positions” ([page 3–4](#)) for the definition of mounting positions M1–M6.
- 4) Install the gearbox on a flat, stable, and rigid foundation for accurate alignment to prevent damage to the reducer housing and the motor. The installation location should provide good air ventilation for the unit and allow for convenient oil filling and draining during unit maintenance. The suggested tolerance of flatness on the base is:
 - For gearbox size 77 and smaller: < 0.1 mm/m
 - For gearbox size 87: < 0.2 mm/m
- 5) Once the gearbox is installed, and before connecting the motor, turn the input quill of the reducer by hand to ensure it is turning freely and is not in a dead-lock condition.
- 6) These IronHorse Helical Bevel Gearboxes connect with NEMA frame motors using a quill style mount. *Paint or spray the motor shaft with anti-seize compound before inserting the motor shaft into the gearbox input quill.*

NOTE: *On some gearboxes, the flange will extend below the base of the gearbox.*

- 7) Once the motor and gearbox are connected, run a no-load test on the motor and the gearbox. Correct any abnormalities regarding misalignment before connecting the gearbox load and beginning regular operation.
- 8) To prevent the factory-filled oil lubricant from splashing out during transportation, the brass breather plug has a rubber ring installed. *Remove the rubber ring from the brass breather plug before start-up.* This will allow the gearbox to vent to the atmosphere, and is necessary to ensure proper operation and prevent overheating.

BREATHER PLUG WITH RING INSTALLED

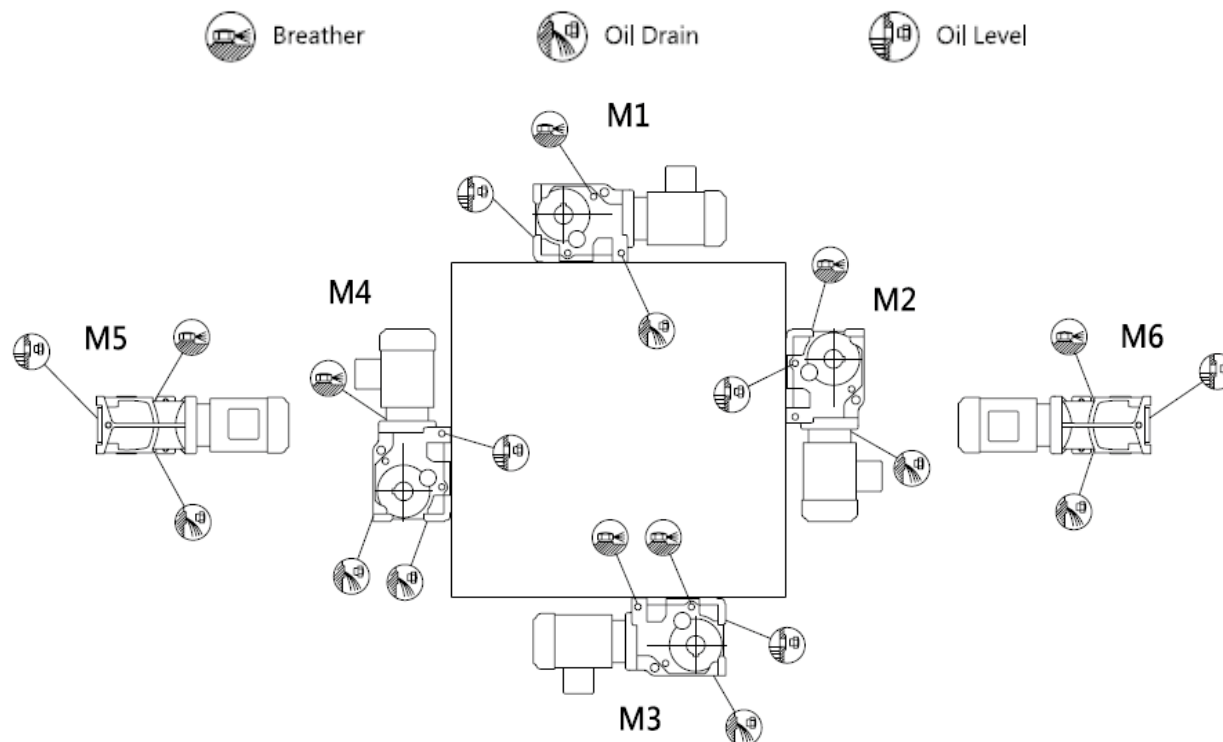


BREATHER PLUG WITH RING REMOVED



- 9) To avoid an overload on the bearings of the output shaft, please refer to the overhung load (OHL) ratings in chapter 2, and ensure that the gearbox is sized properly for the overhung load.

MOUNTING POSITIONS



STARTUP PROCEDURE

- 1) **Check gearbox oil level before starting up.** Please refer to the lubrication section for instructions on proper unit lubrication. Unit lubrication requirements vary depending upon mounting positions.
- 2) Run-In Procedure – This helical & bevel gearbox does **not** require a run-in procedure; however, **the oil should be changed after the first 500 hours of operation.**

INSPECTION AND MAINTENANCE

Check the oil level regularly and change as recommended.

- 1) Change the oil after the first 500 hours of use; subsequent oil changes are needed every 2,500 hours of operation. Regular checks of oil level and conditions are recommended on a more frequent basis.
- 2) Regularly inspect all seals for leaks. If leaks are present, discontinue use until seals have been replaced. Seal sizes are listed later in this chapter ([page 3-7](#)).
- 3) Check for noise during regular operation. Noise coming from the unit may indicate a broken bearing. Discontinue use until bearings have been replaced. Bearing sizes are listed later in this chapter ([page 3-7](#)).
- 4) Regularly check the brass breather vent holes of the gearbox and ensure sure that all openings are free of clogs and debris. *The exterior of the gearbox should be kept clean.* The unit housing dissipates heat, and must be kept free of debris to reduce heat buildup.
- 5) Check installation bolts regularly and tighten as required.
- 6) Any replacement parts used should be equivalent to the original factory standards. When replacement parts are used, a running test should be conducted without load before the unit is returned to full operation.
- 7) This equipment requires regular maintenance. Keep a log of oil changes and bolt tightening. Log any equipment issues and all corrective actions taken for warranty records.

LUBRICATION**LUBRICANT SELECTION AND VOLUME**

- 1) All IronHorse helical bevel gearboxes are initially filled with the proper quantity of lubricant for an M1 mounting position. If you want to change the assembly mounting position, please move the breather plug, oil gauge, and drain plug to the correct positions, and add or remove oil to the correct specified fill level. The breather plug should always be located at the highest point above the oil fill level.



NOTE: Failure to move the breather plug to the correct position for the selected mounting position may result in overheating of the unit, potentially causing damage to seals and bearings, and leading to leaks and eventual product failure.

- 2) A certain brand and specification of oil is required and unique to a particular helical bevel gearbox. Do not mix different brands and specification types of oil. Oil suggestions for IronHorse units are as follows:

IronHorse Helical Bevel Gearbox Lubricant Selection				
Gearbox Temperature	CPC	ISO VG	Mobil	Shell
Standard Load @ 1750 RPM Input				
-30°C to -15°C	HD100	VG100	Mobilgear 627	Omala 100
-15°C to -3°C	HD150	VG150	Mobilgear 629	Omala 150
-3°C to 23°C	HD220	VG220	Mobilgear 630	Omala 220
23°C to 40°C	HD320	VG320	Mobilgear 632	Omala 320
40°C to 80°C	HD460	VG460	Mobilgear 634	Omala 460
Heavy Load @ 1750 RPM Input				
-30°C to -15°C	HD150	VG150	Mobilgear 629	Omala 150
-15°C to -3°C	HD220	VG220	Mobilgear 630	Omala 220
-3°C to 23°C	HD320	VG320	Mobilgear 632	Omala 320
23°C to 40°C	HD460	VG460	Mobilgear 634	Omala 460
40°C to 80°C	HD680	VG680	Mobilgear 636	Omala 680

IronHorse Helical Bevel Gearbox Lubricant Volume (unit = liter)					
Mounting Position	Gearbox Size				
	37	47	67	77	87
M1	0.50	0.80	1.10	2.10	3.70
M2	1.00	1.30	2.40	4.10	8.20
M3	1.00	1.60	2.70	4.60	8.80
M4	1.40	2.15	3.70	5.90	11.10
M5	1.00	1.60	2.60	4.40	8.00
M6	1.00	1.60	2.60	4.40	8.00



NOTE: IronHorse helical bevel gearboxes are shipped prefilled with CPC HD320 oil for an M1 mounting position. Operator must add or remove oil if alternative mounting positions are used. Recommended oil fill volumes are shown in the table above, but these values are estimates and should not be used exclusively to correctly set the gearbox oil level. ALWAYS fill the reducer to the correct oil level plug and recheck after one (1) week of use.

- 3) Before replacing existing oil, completely flush and drain the interior of the reducer.
- 4) During operation, if the units heats above 80°C or if any abnormal noise occurs, please shut down the unit immediately. Check for proper oil fill, oil type, leaking seals and broken bearings and fix or replace as necessary before restarting the unit again. Do not run the unit if problems exist.

LUBRICANT PLUG LOCATIONS & FILL INSTRUCTIONS

All IronHorse helical bevel gearboxes have multiple locations for the Breather/Fill, Level, and Drain plugs, and the units are shipped with the plugs installed as configured for an M1 mounting position. If the units are installed in an orientation other than M1, the plugs are to be reinstalled by the user in the applicable locations as shown in “Mounting Positions” ([page 3-4](#)). The oil Drain plug should always be placed in the lowest position, and the Breather/Fill plug should always be placed in the highest position on the gearbox.

When filling the gearbox with oil, remove the oil Breather/Fill and Level plugs. Add oil through the Fill plug hole until it begins to come out of the Level plug hole. Replace both of the plugs. The gearbox now has enough oil inside.



NOTE: The breather plug should always be placed in the filler position. When filling the gearbox with oil, remove the breather plug, add the oil, and reinstall the breather plug.

RECOMMENDED LUBRICANT: CPC E.P. LUBRICANT HD

CPC E.P. Lubricants HD are engineered for exceptional metal surface adhesion, and are formulated from highly refined base oils and special additives, including EP (extreme pressure) additives, anti-oxidation, anti-rust, anti-foamers, and more. CPC Lubricants also contain sulfur-phosphorus EP additives to form a tenacious oil film on metal surfaces that can endure high E.P. and vibration loads to prevent gear-surface overheating and premature, excessive wear. These oils pass FZG gear test (DIN 51354) with pass load stage 12+.

These oils possess excellent oxidative stability, and they effectively prevent gum formation and oil degradation for extended service. These oils are suitable for lubrication of heavily loaded bearings and gears.

CPC E.P. Lubricants are available in three packages:

- Bulk (HD320, HD460, and HD680)
- 200 liter drum
- 19 liter pail (HD150, HD220, HD320 and HD460)

CPC E.P. Lubricants HD Specifications								
Grade Number	HD32	HD68	HD100	HD150	HD220	HD320*	HD460	HD680
Gravity, API, 15.6°C	30.4	28.5	27.8	27.1	26.5	25.9	25.3	24.4
Viscosity, Kin., cSt @ 40°C	31.15	67.2	98.1	143.6	212.2	310.5	440.4	656.2
Viscosity, Kin., cSt @ 100°C	5.26	8.62	11.16	14.38	18.59	23.70	29.80	38.68
Viscosity Index	99	99	99	98	97	96	96	96
Pour Point, °C	-18	-18	-18	-18	-18	-18	-18	-12
Flash Point, COC, °C	224	240	256	264	278	290	310	316
Color, D1500	L3.0	3.0	L4.0	4.0	L4.5	4.5	4.5	L5.0
TAN, mgKOH/g	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Timken EP, OK Load, Lbs	65	65	65	65	65	65	65	70
Carbon Residue, Rams., %	0.25	0.27	0.34	0.40	0.45	0.51	0.56	0.64
Sulfated Ash, %	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Product Number	LA82032	LA82068	LA82100	LA82150	LA82220	LA82320	LA82460	LA82680
* IronHorse helical bevel gearboxes are shipped prefilled with CPC HD320 oil for an M1 mounting position. (Operator must add or remove oil if alternative mounting positions are used.)								

SEAL SIZES

IronHorse Helical Bevel Gearbox Seal Sizes		
<i>Gearbox Model</i>	<i>Input Seal Size [mm]</i>	<i>Output Seal Size [mm]</i>
HBR-37-xxx-A	30x47x6	45x75x8
HBR-37-xxx-B	40x55x8	45x75x8
HBR-47-xxx-A	30x47x6	50x80x12
HBR-47-xxx-B	40x55x8	50x80x12
HBR-47-xxx-C	45x60x7	50x80x12
HBR-67-xxx-A	30x47x6	55x90x13
HBR-67-xxx-B	40x55x8	55x90x13
HBR-67-xxx-C	45x60x7	55x90x13
HBR-77-xxx-B	40x55x8	70x110x12
HBR-77-xxx-C	45x60x7	70x110x12
HBR-77-xxx-D	55x80x10	70x110x12
HBR-87-xxx-C	45x60x7	85x130x12
HBR-87-xxx-D	55x80x10	85x130x12
HBR-87-xxx-E	65x90x12	85x130x12

BEARING SIZES

IronHorse Helical Bevel Gearbox Bearing Sizes		
<i>Gearbox Model</i>	<i>Input Bearings (2 required)</i>	<i>Output Bearing</i>
HBR-37-xxx-A	6006ZZ	6009ZZ
HBR-37-xxx-B	6008ZZ	6009ZZ
HBR-47-xxx-A	6006ZZ	6010ZZ
HBR-47-xxx-B	6008ZZ	6010ZZ
HBR-47-xxx-C	6009ZZ	6010ZZ
HBR-67-xxx-A	6006ZZ	32011
HBR-67-xxx-B	6008ZZ	32011
HBR-67-xxx-C	6009ZZ	32011
HBR-77-xxx-B	6008ZZ	32014
HBR-77-xxx-C	6009ZZ	32014
HBR-77-xxx-D	6210ZZ + 6211ZZ	32014
HBR-87-xxx-C	6009ZZ	32017
HBR-87-xxx-D	6210ZZ + 6211ZZ	32017
HBR-87-xxx-E	6212ZZ + 6213ZZ	32017

STORAGE

If the helical gearbox won't be used immediately and needs to be placed in storage for a period of time that exceeds six months, please pay attention to the special storage instructions outlined below.

- 1) If the gearbox is to be placed in long term storage, care should be taken by applying anti-corrosion inhibitors on all non-coated parts, including the input shaft, output shaft, flange, and foot mounts. Units should be stored under a waterproof cover, and care should be taken to keep the units free of dust and debris.
- 2) All units should be stored in a dry, dust free environment. Avoid exposing the units to sunlight, heat, and humidity during storage.
- 3) All units should be stored in a temperature-controlled environment, between 5° and 40°C (41° and 104°F).
- 4) If the storage time exceeds 2 years, please inspect units carefully before use. Units should be examined for rust. *Units with rust should not be placed into operation.* Check all bearings, seals, oil fill levels, and oil specifications before use. Refer to the Lubrication section ([page 3-5](#)) for proper oil specifications.

GLOSSARY OF TERMS



TABLE OF CONTENTS

<i>Glossary of Gearbox Terms</i>	<i>A-2</i>
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GLOSSARY OF GEARBOX TERMS

AXIAL MOVEMENT

Often called “endplay.” The endwise movement of motor or gear shafts. Usually expressed in thousandths of an inch.

BACK DRIVING

Driving the output shaft of a gearbox to increase speed rather than reduce speed. Helical bevel gearboxes are not suitable for service to increase speed.

BACKLASH

Rotational movement of the output shaft clockwise and counterclockwise, while holding the input shaft stationary. Usually expressed in thousandths of an inch and measured at a specific radius at the output shaft.

BEVEL GEAR

A gear having teeth cut into a conical surface, meshing with a similar gear set at right angles.

EFFICIENCY

A ratio of the input power compared to the output power, usually expressed as a percentage.

FLANGED REDUCER

Usually used to refer to a gearbox having provisions for close coupling of a motor either via a hollow (quill) shaft or flexible coupling. Most often a NEMA C-face motor is used.

GEARBOX

Also called a Speed Reducer. An enclosed set of gears used in mechanical power transmission to reduce speed and increase torque.

HELICAL GEAR

Parallel axis gear that features teeth that are cut at an angle to allow for smooth and quiet operation.

INPUT POWER

The power applied to the input shaft of a gearbox. There are separate ratings for Mechanical Input Power, Thermal Input Power, and Nominal Motor Horsepower.

K FACTOR

Also called an Overhung Load Factor. A constant used to modify the overhung load rating of a gearbox based on the type of load applied on the shaft. Use the K factor either to increase the calculated overhung load, or to reduce the gearbox overhung load rating.

MECHANICAL RATINGS

The maximum power or torque a gearbox can transmit based on the strength and durability of its components. Some applications require the gearbox Mechanical Ratings to be reduced by a Service Factor.

MOUNTING POSITION

The relationship of the input and output shafts of a gearbox relative to horizontal.

NOMINAL MOTOR HORSEPOWER

The highest horsepower 1800 rpm motor that can be used with the gearbox under 1.0 service factor conditions. This rating decreases as the motor speed decreases, and as the service factor increases.

OUTPUT HORSEPOWER

The amount of horsepower available at the output shaft of a gearbox. Output horsepower is always less than the input horsepower due to the efficiency of the gearbox.

OVERHUNG LOAD

A force applied at right angles to a shaft beyond its outermost bearing. This shaft-bending load must be supported by the bearing. Overhung load ratings are listed for each gearbox size, and should not be exceeded. Some applications require the gearbox Overhung Load rating to be reduced by a K Factor and/or a Service Factor.

OVERHUNG LOAD FACTOR

Also called K Factor. A constant used to modify the overhung load rating of a gearbox based on the type of load applied on the shaft. Use the Overhung Load Factor either to increase the calculated overhung load, or to reduce the gearbox overhung load rating.

PRIME MOVER

In industry, the prime mover is most often an electric motor, although engines, hydraulic, or air motors are occasionally used. Special considerations are called for when other than an electric motor is the prime mover.

SELF-LOCKING

The inability of a reducer to be driven backwards by its load. No IronHorse helical gearbox should be considered self-locking.

SERVICE FACTOR (FOR GEARBOX)

A constant used to modify the Mechanical Rating of a gearbox based on the duration of service and characteristics of the driven load. Use the Service Factor either as a multiplier to increase the calculated loads, or as a divisor to reduce the gearbox Mechanical and Overhung Load ratings.

SERVICE FACTOR (FOR MOTORS)

Refers to a motor's ability to handle a load greater than the motor's rated horsepower on a continuous basis.

SPEED REDUCER

Also called a Gearbox. An enclosed set of gears used in mechanical power transmission to reduce speed and increase torque.

THERMAL RATINGS

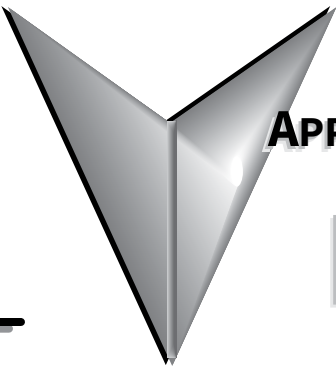
The power or torque a gearbox can transmit continuously. These ratings are based upon the cast-iron gearbox's ability to dissipate the heat caused by friction.

THRUST LOAD

Forces along the axis of the output shaft, usually encountered in vertical-drive applications.

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GEARBOX SELECTION



APPENDIX

B

TABLE OF CONTENTS

Gearbox Selection Procedure.B-2

Gearbox Selection Steps B-2

Gearbox Selection Example. B-2

AGMA Service Factors.B-5

GEARBOX SELECTION PROCEDURE

GEARBOX SELECTION STEPS

- 1) Determine the torque and speed required for the load.
- 2) Determine the overall speed ratio of motor speed to load speed.
- 3) Determine the gearbox ratio as well as any reduction outside the gearbox (pulleys, gears, etc.).
- 4) Determine the applicable service factor and overhung load K factor.
- 5) Determine the gearbox real output torque required, and select a gearbox with a higher Maximum Thermal Output Torque rating.
- 6) Determine the gearbox design output torque required (torque with service factor applied), and select a gearbox with a higher Maximum Mechanical Output Torque rating. (Gearbox must also meet requirement #5.)
- 7) Determine the required sizes of pulleys, gears, etc., and determine the overhung load force. Select a gearbox with a higher Overhung Load rating. (Gearbox must also meet requirements #5 & #6.)
- 8) Confirm that the selected gearbox meets the applicable system requirements.
- 9) Select a compatible motor.

GEARBOX SELECTION EXAMPLE

(Refer to the specifications tables for gearbox specifications, service factors, and K factors.)

A conveyor will run 8 hours/day with moderate shock loading. The conveyor will be driven by a v-belt and needs to be driven at approximately 20 rpm. The motor used will have a nominal speed of 1800 rpm (1750 rpm actual speed). The conveyor will require 5500 lb·in of torque.

- 1) Required torque = 5500 lb·in; required speed = 20 rpm
- 2) Determine the overall speed ratio of motor speed to load speed:

$$\text{Overall speed ratio} = \text{motor speed} / \text{load speed} = 1750 / 20 = 87.5 \text{ (about 88:1)}$$
- 3) Determine pulley ratios at available gearbox ratios:

$$\text{Pulley ratio} = (\text{overall speed ratio}) / (\text{gearbox ratio})$$

For 10:1 gearbox:	pulley ratio = $87.5/10 = 8.75$
For 20:1 gearbox:	pulley ratio = $87.5/20 = 4.38$
For 25:1 gearbox:	pulley ratio = $87.5/25 = 3.50$
For 40:1 gearbox:	pulley ratio = $87.5/40 = 2.19$
For 60:1 gearbox:	pulley ratio = $87.5/60 = 1.46$
For 65:1 gearbox:	pulley ratio = $87.5/65 = 1.35$
For 80:1 gearbox:	pulley ratio = $87.5/80 = 1.09$
For 85:1 gearbox:	pulley ratio = $87.5/85 = 1.03$
For 120:1 gearbox:	pulley ratio = $87.5/120 = 0.73$

$$\text{Pulley ratio} = (\text{conveyor or pulley diameter}) / (\text{gearbox pulley diameter})$$
- 4) Determine service factor (SF) and overhung load factor (K) from applicable tables:
 SF = 1.25 due to moderate shock loading and 3–10 hours/day operation
 K = 1.5 due to V-belt

- 5) Use specifications table to select gearbox with Max Output Torque Rating > required real torque:

$$\text{Gearbox required real torque} = (\text{final torque}) / (\text{pulley ratio})$$

For 10:1 gearbox:	(5500 lb·in) / 8.75 = 628.57 lb·in;	use HBR-37-x or larger
For 20:1 gearbox:	(5500 lb·in) / 4.38 = 1255.71 lb·in;	use HBR-47-x or larger
For 25:1 gearbox:	(5500 lb·in) / 3.50 = 1571.43 lb·in;	use HBR-37-x
For 40:1 gearbox:	(5500 lb·in) / 2.19 = 2511.42 lb·in;	use HBR-47-x or larger
For 60:1 gearbox:	(5500 lb·in) / 1.46 = 3767.12 lb·in;	use HBR-77-x or larger
For 65:1 gearbox:	(5500 lb·in) / 1.35 = 4074.07 lb·in;	use HBR-67-x or larger
For 80:1 gearbox:	(5500 lb·in) / 1.09 = 5045.87 lb·in;	use HBR-77-x or larger
For 85:1 gearbox:	(5500 lb·in) / 1.03 = 5339.81 lb·in;	use HBR-67-x or larger
For 120:1 gearbox:	(5500 lb·in) / 0.73 = 7534.25 lb·in;	use HBR-77-x or larger

- 6) Use specifications table to select gearbox with Max Output Torque Rating > required design torque:

$$\text{Gearbox required design torque} = (\text{gearbox required real torque}) / (\text{service factor})$$

For 10:1 gearbox:	(628.57 lb·in) / (1.25) = 785.72 lb·in;	use HBR-37-x or larger
For 20:1 gearbox:	(1255.71 lb·in) / (1.25) = 1569.64 lb·in;	use HBR-47-x or larger
For 25:1 gearbox:	(1571.43 lb·in) / (1.25) = 1964.29 lb·in;	none available
For 40:1 gearbox:	(2511.42 lb·in) / (1.25) = 3139.28 lb·in;	use HBR-47-x or larger
For 60:1 gearbox:	(3767.12 lb·in) / (1.25) = 4708.90 lb·in;	use HBR-77-x or larger
For 65:1 gearbox:	(4074.07 lb·in) / (1.25) = 5092.59 lb·in;	use HBR-67-x or larger
For 80:1 gearbox:	(5045.87 lb·in) / (1.25) = 6307.34 lb·in;	use HBR-77-x or larger
For 85:1 gearbox:	(5339.81 lb·in) / (1.25) = 6674.76 lb·in;	use HBR-67-x or larger
For 120:1 gearbox:	(7534.25 lb·in) / (1.25) = 9417.81 lb·in;	use HBR-77-x or larger

- 7) Use the gearbox overhung load ratings from the specifications table to determine the minimum allowable pulley diameter.

Select gearbox with Overhung Load Rating > overhung load force:

Gearbox required OHL rating =

$$(\text{gearbox required real torque})(K)(SF) / (\text{gearbox pulley diameter} / 2)$$

$$\text{Minimum gearbox pulley diameter} = (T)(K)(SF)(2) / (\text{OHL rating})$$

$$\text{Conveyor pulley diameter} = (\text{gearbox pulley diameter})(\text{pulley ratio})$$

For 10:1, HBR-37-010-A gearbox:

$$\text{Minimum gearbox pulley diameter} = (628.57 \text{ lb·in})(1.5)(1.25)(2) / (475 \text{ lb}) = 4.96" \text{ (use 5.0")}$$

$$\text{Conveyor pulley diameter} = (5.0")(8.75) = 43.75"$$

[pulley size is too large; try next higher gearbox ratio]

For 20:1, HBR-47-020-B gearbox:

$$\text{Minimum gearbox pulley diameter} = (1255.71 \text{ lb·in})(1.5)(1.25)(2) / (690 \text{ lb}) = 6.82" \text{ (use 6.8")}$$

$$\text{Conveyor pulley diameter} = (6.8")(4.38) = 29.78"$$

[pulley size is too large; try next higher gearbox ratio]

For 40:1, HGR-67-040-A gearbox:

$$\text{Minimum gearbox pulley diameter} = (2511.42 \text{ lb·in})(1.5)(1.25)(2) / (2140 \text{ lb}) = 4.4" \text{ (use 4.4")}$$

$$\text{Conveyor pulley diameter} = (4.4")(2.19) = 9.63" \text{ (use 9.4")}$$

Select HGR-67-040-A gearbox, 4.4" gearbox pulley, and 9.4" conveyor pulley.

For 60:1, HBR-67-065-A gearbox:

N/A – All gearboxes of the same frame size are the same price, yet the smaller ratio gearboxes offer higher efficiency and power characteristics than higher ratio gearboxes. Therefore, the HGR-67-040-A gearbox is preferable over the HBR-67-065-A gearbox for this application.

- 8) Check results against original speed and torque requirements:

NOTE: Actual gearbox ratio is used from the specifications table.

- a) Conveyor speed = (motor speed) / (gearbox ratio)(pulley ratio) =
 $(1750 \text{ rpm}) / (37.98)(9.4''/4.4'') = 21.57 \text{ rpm}$
- b) Max real torque available at conveyor =
 (gearbox output torque from specification table)(pulley ratio) =
 $(5730 \text{ lb}\cdot\text{in})(2.19) = 12534.38 \text{ lb}\cdot\text{in}$
- c) Max design torque available at conveyor =
 (gearbox output torque from specification table)(pulley ratio) / SF =
 $(5730 \text{ lb}\cdot\text{in})(9.4''/4.4'') / 1.25 = 9793.09 \text{ lb}\cdot\text{in}$

The speed is very close to required and both maximum torque values are greater than the 5500 lb·in required by the load. Minor changes to pulley sizes can be tried to get conveyor speed closer to the required 20 rpm.

- 9) Select a motor and check torque transmitted to the load:

From the gearbox spec tables, HBR-67-040-A:

Max mechanical input power @ 1.0 SF = 4.62 hp

Max mechanical input power @ 1.25 SF = (max input power) / (SF) =
 $4.62 \text{ hp} / 1.25 = 3.70 \text{ hp}$ (use 3 hp)

- a) Select 3 hp motor, and check for adequate torque at the load:
 Torque = Power / Speed [conversion factor: 1 hp = 63,025 lb·in·rpm]
 Torque load = $(63025 \text{ lb}\cdot\text{in}\cdot\text{rpm})(\text{motor hp}) / (\text{motor rpm}/(\text{gearbox ratio})(\text{pulley ratio})) =$
 $(63025)(3) / (1750 / ((40)(9.4/4.4))) = 9232.75 \text{ lb}\cdot\text{in}$
Although a 3 hp motor can be used, the torque value far exceeds the required 5500 lb·in.

- b) Try 2 hp motor to reduce motor size:
 Torque load = $(63025 \text{ lb}\cdot\text{in}\cdot\text{rpm})(\text{motor hp}) / (\text{motor rpm}/(\text{gearbox ratio})(\text{pulley ratio})) =$
 $(63025)(2) / (1750 / ((40)(9.4/4.4))) = 6155.17 \text{ lb}\cdot\text{in}$
This torque value is greater than the required 5500 lb·in required by the load.

Final Selection: **HBR-67-040-A gearbox 2hp motor**

AGMA SERVICE FACTORS

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Agitators (mixers)			
Pure liquids	1.00	1.00	1.25
Liquids and solids	1.00	1.25	1.50
Liquids - variable density	1.00	1.25	1.50
Blowers			
Centrifugal	1.00	1.00	1.25
Lobe	1.00	1.25	1.50
Vane	1.00	1.25	1.50
Brewing and distilling			
Bottling machinery	1.00	1.00	1.25
Brew kettles - continuous duty	1.25	1.25	1.25
Cookers - continuous duty	1.25	1.25	1.25
Mash tubs - continuous duty	1.25	1.25	1.25
Scale hopper - frequent starts	1.25	1.25	1.50
Can filling machines	1.00	1.00	1.25
Car dumpers	1.50	1.75	2.00
Car pullers	1.00	1.25	1.50
Clarifiers	1.00	1.00	1.25
Classifiers	1.00	1.25	1.50
Clay working machinery			
Brick press	1.50	1.75	2.00
Briquette machine	1.50	1.75	2.00
Pug mill	1.00	1.25	1.50
Compactors	2.00	2.00	2.00
Compressors			
Centrifugal	1.00	1.00	1.25
Lobe	1.00	1.25	1.50
Reciprocating, multi-cylinder	1.50	1.50	1.75
Reciprocating, single-cylinder	1.75	1.75	2.00
1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0. 2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed. 3) Anti-friction bearings only. Use 1.5 for sleeve bearings. 4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)				
Application	Total Operation [hr/day]			
	Up to 3	3 to 10	Over 10	
Cranes ¹⁾				
Dry dock				
Main hoist	2.50	2.50	2.50	
Auxiliary hoist	2.50	2.50	3.00	
Boom hoist	2.50	2.50	3.00	
Slewing drive	2.50	2.50	3.00	
Traction drive	3.00	3.00	3.00	
Container				
Main hoist	3.00	3.00	3.00	
Boom hoist	2.00	2.00	2.00	
Trolley drive				
Gantry drive	3.00	3.00	3.00	
Traction drive	2.00	2.00	2.00	
Mill duty				
Main hoist	3.50	3.50	3.50	
Auxiliary	3.50	3.50	3.50	
Bridge	2.50	3.00	3.00	
Trolley travel	2.50	3.00	3.00	
Industrial duty				
Main	2.50	2.50	3.00	
Auxiliary	2.50	2.50	3.00	
Bridge	2.50	3.00	3.00	
Trolley travel	2.50	3.00	3.00	
Crusher				
Stone or ore	1.75	1.75	2.00	
Dredges				
Cable reels	1.25	1.25	1.50	
Conveyors	1.25	1.25	1.50	
Cutter head drives	2.00	2.00	2.00	
Pumps	2.00	2.00	2.00	
Screen drives	1.75	1.75	2.00	
Stackers	1.25	1.25	1.50	
Winches	1.25	1.25	1.50	
Elevators				
Bucket	1.00	1.25	1.50	
Centrifugal discharge	1.00	1.00	1.25	
Escalators	1.00	1.00	1.25	
Freight	1.00	1.25	1.50	
Gravity discharge	1.00	1.00	1.25	
¹⁾ Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0. ²⁾ Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed. ³⁾ Anti-friction bearings only. Use 1.5 for sleeve bearings. ⁴⁾ A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.				
(table continued next page)				

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Extruders			
General	1.50	1.50	1.50
Plastics			
Variable speed drive	1.50	1.50	1.50
Fixed speed drive	1.75	1.75	1.75
Rubber			
Continuous screw operation	1.75	1.75	1.75
Intermittent screw operation	1.75	1.75	1.75
Fans			
Centrifugal	1.00	1.00	1.25
Cooling towers	2.00	2.00	2.00
Forced draft	1.25	1.25	1.25
Induced draft	1.50	1.50	1.50
Industrial & mine	1.50	1.50	1.50
Feeders			
Apron	1.00	1.25	1.50
Belt	1.00	1.25	1.50
Disc	1.00	1.00	1.25
Reciprocating	1.50	1.75	2.00
Screw	1.00	1.25	1.50
Food industry			
Cereal cooker	1.00	1.00	1.25
Dough mixer	1.25	1.25	1.50
Meat grinders	1.25	1.25	1.50
Slicers	1.25	1.25	1.50
Generators and exciters	1.00	1.00	1.25
Hammer mills	1.75	1.75	2.00
Hoists			
Heavy duty	1.75	1.75	2.00
Medium duty	1.25	1.25	1.50
Skip hoist	1.25	1.25	1.50
Laundry			
Tumblers	1.25	1.25	1.50
Washers	1.50	1.50	2.00
1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0. 2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed. 3) Anti-friction bearings only. Use 1.5 for sleeve bearings. 4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Lumber industry			
Barkers - spindle feed	1.25	1.25	1.50
Main drive	1.75	1.75	1.75
Conveyors - burner	1.25	1.25	1.50
Main or heavy duty	1.50	1.50	1.50
Main log	1.75	1.75	2.00
Re-saw, merry-go-round	1.25	1.25	1.50
Conveyors			
Slab	1.75	1.75	2.00
Transfer	1.25	1.25	1.50
Chains			
Floor	1.50	1.50	1.50
Green	1.50	1.50	1.75
Cut-off saws			
Chain	1.50	1.50	1.75
Drag	1.50	1.50	1.75
Debarking drums	1.75	1.75	2.00
Feeds			
Edger	1.25	1.25	1.50
Gang	1.75	1.75	1.75
Trimmer	1.25	1.25	1.50
Log deck	1.75	1.75	1.75
Log hauls - incline - well type	1.75	1.75	1.75
Log turning devices	1.75	1.75	1.75
Planer feed	1.25	1.25	1.50
Planer tilting hoists	1.50	1.50	1.50
Rolls - live-off bearing - roll cases	1.75	1.75	1.75
Sorting table	1.25	1.25	1.50
Tipple hoist	1.25	1.25	1.50
Transfers			
Chain	1.50	1.50	1.75
Craneway	1.50	1.50	1.75
Tray drives	1.25	1.25	1.50
Veneer lathe drives	1.25	1.25	1.50
1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0. 2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed. 3) Anti-friction bearings only. Use 1.5 for sleeve bearings. 4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Metal mills			
Draw bench carriage and main drive	1.25	1.25	1.50
Runout table			
Non-reversing			
Group drives	1.50	1.50	1.50
Individual drives	2.00	2.00	2.00
Reversing	2.00	2.00	2.00
Slab pushers	1.50	1.50	1.50
Shears	2.00	2.00	2.00
Wire drawing	1.25	1.25	1.50
Wire winding machine	1.25	1.50	1.50
Metal strip processing machinery			
Bridles	1.25	1.25	1.50
Coilers & uncoilers	1.00	1.00	1.25
Edge trimmers	1.00	1.25	1.50
Flatteners	1.25	1.25	1.50
Loopers (accumulators)	1.00	1.00	1.25
Pinch rolls	1.25	1.25	1.50
Scrap choppers	1.25	1.25	1.50
Shears	2.00	2.00	2.00
Slitters	1.00	1.25	1.50
Mills, rotary type			
Spur ring gear	2.00	2.00	2.00
Helical ring gear	1.50	1.50	1.50
Direct connected	2.00	2.00	2.00
Cement kilns	1.50	1.50	1.50
Dryers & coolers	1.50	1.50	1.50
Mixers			
Concrete	1.25	1.25	1.50
1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0. 2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed. 3) Anti-friction bearings only. Use 1.5 for sleeve bearings. 4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Paper mills ²⁾			
Agitator (mixer)	1.50	1.50	1.50
Agitator for pure liquors	1.25	1.25	1.25
Barking drums	2.00	2.00	2.00
Barkers - mechanical	2.00	2.00	2.00
Beater	1.50	1.50	1.50
Breaker stack	1.25	1.25	1.25
Calender ³⁾	1.25	1.25	1.25
Chipper	2.00	2.00	2.00
Chip feeder	1.50	1.50	1.50
Coating rolls	1.25	1.25	1.25
Conveyors			
Chip, bark, chemical	1.25	1.25	1.25
Log (including slab)	2.00	2.00	2.00
Couch rolls	1.25	1.25	1.25
Cutter	2.00	2.00	2.00
Cylinder molds	1.25	1.25	1.25
Dryers ³⁾			
Paper machine	1.25	1.25	1.25
Conveyor type	1.25	1.25	1.25
Embosser	1.25	1.25	1.25
Extruder	1.50	1.50	1.50
Fourdrinier rolls (includes lump breaker, dandy roll, wire turning, and return rolls)	1.25	1.25	1.25
Jordan	1.50	1.50	1.50
Kiln drive	1.50	1.50	1.50
Mt. Hope roll	1.25	1.25	1.25
Paper rolls	1.25	1.25	1.25
Platter	1.50	1.50	1.50
Presses - felt & suction	1.25	1.25	1.25
Pulper	2.00	2.00	2.00
Pumps - vacuum	1.50	1.50	1.50
Reel (surface type)	1.25	1.25	1.25
Screens			
Chip	1.50	1.50	1.50
Rotary	1.50	1.50	1.50
Vibrating	2.00	2.00	2.00
Size press	1.25	1.25	1.25
Super calender ⁴⁾	1.25	1.25	1.25
Thickener (AC motor)	1.50	1.50	1.50
Thickener (DC motor)	1.25	1.25	1.25
<p>1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0.</p> <p>2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed.</p> <p>3) Anti-friction bearings only. Use 1.5 for sleeve bearings.</p> <p>4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.</p>			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Washer (AC motor)	1.50	1.50	1.50
Washer (DC motor)	1.25	1.25	1.25
Wind and unwind stand	1.00	1.00	1.00
Winders (surface type)	1.25	1.25	1.25
Yankee dryers ³⁾	1.25	1.25	1.25
Plastics industry			
Primary processing			
Batch mixers	1.75	1.75	1.75
Continuous mixers	1.50	1.50	1.50
Batch drop mill - 2 smooth rolls	1.25	1.25	1.25
Continuous feed, holding & blend mill	1.25	1.25	1.25
Compounding mill	1.25	1.25	1.25
Calenders	1.50	1.50	1.50
Secondary processing			
Blow molders	1.50	1.50	1.50
Coating	1.25	1.25	1.25
Film	1.25	1.25	1.25
Pipe	1.25	1.25	1.25
Pre-plasticizers	1.50	1.50	1.50
Rods	1.25	1.25	1.25
Sheet	1.25	1.25	1.25
Tubing	1.25	1.25	1.50
Pullers - barge haul	1.25	1.25	1.50
Pumps			
Centrifugal	1.00	1.00	1.25
Proportioning	1.25	1.25	1.50
Reciprocating			
Single acting, 3 or more cylinders	1.25	1.25	1.50
Double acting, 2 or more cylinders	1.25	1.25	1.50
Rotary			
Gear type	1.00	1.00	1.25
Lobe	1.00	1.00	1.25
Vane	1.00	1.00	1.25
<p>1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0.</p> <p>2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed.</p> <p>3) Anti-friction bearings only. Use 1.5 for sleeve bearings.</p> <p>4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.</p>			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Rubber industry			
Intensive internal mixers			
Batch mixers	1.75	1.75	1.75
Continuous mixers	1.50	1.50	1.50
Mixing mill - 2 smooth rolls (if corrugated rolls are used, then use the same service factors that are used for a cracker warmer)	1.50	1.50	1.50
Batch drop mill - 2 smooth rolls	1.50	1.50	1.50
Cracker warmer - 2 rolls; 1 corrugated roll	1.75	1.75	1.75
Cracker - 2 corrugated rolls	2.00	2.00	2.00
Holding, feed & blend mill - 2 rolls	1.25	1.25	1.25
Refiner - 2 rolls	1.50	1.50	1.50
Calenders	1.50	1.50	1.50
Sand muller	1.25	1.25	1.50
Sewage disposal equipment			
Bar screens	1.25	1.25	1.25
Chemical feeders	1.25	1.25	1.25
Dewatering screens	1.50	1.50	1.50
Scum breakers	1.50	1.50	1.50
Slow or rapid mixers	1.50	1.50	1.50
Sludge collectors	1.25	1.25	1.25
Thickeners	1.50	1.50	1.50
Vacuum filters	1.50	1.50	1.50
Screens			
Air washing	1.00	1.00	1.25
Rotary - stone or gravel	1.25	1.25	1.50
Traveling water intake	1.00	1.00	1.25
Sugar industry			
Beet slicer	2.00	2.00	2.00
Cane knives	1.50	1.50	1.50
Crushers	1.50	1.50	1.50
Mills (low speed end)	1.75	1.75	1.75
<p>1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0.</p> <p>2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated base speed.</p> <p>3) Anti-friction bearings only. Use 1.5 for sleeve bearings.</p> <p>4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.</p>			
(table continued next page)			

A.G.M.A. Service Factors for Spur, Helical & Bevel Gear Drives & Reducers with Uniform Power Source (continued)			
Application	Total Operation [hr/day]		
	Up to 3	3 to 10	Over 10
Textile industry			
Batchers	1.25	1.25	1.50
Calenders	1.25	1.25	1.50
Cards	1.25	1.25	1.50
Dry cans	1.25	1.25	1.50
Dryers	1.25	1.25	1.50
Dyeing machinery	1.25	1.25	1.50
Looms	1.25	1.25	1.50
Mangles	1.25	1.25	1.50
Nappers	1.25	1.25	1.50
Pads	1.25	1.25	1.50
Slashers	1.25	1.25	1.50
Soapers	1.25	1.25	1.50
Spinners	1.25	1.25	1.50
Tenter frames	1.25	1.25	1.50
Washers	1.25	1.25	1.50
Winders	1.25	1.25	1.50
<p>1) Crane drives are to be selected based on gear tooth bending strength. Contact gear manufacturer for strength ratings. Service factor in durability shall be a minimum of 1.0.</p> <p>2) Service factors for paper mill applications are applied to the nameplate rating of the electric drive motor at the motor rated based speed.</p> <p>3) Anti-friction bearings only. Use 1.5 for sleeve bearings.</p> <p>4) A service factor of 1.00 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.</p>			

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