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CARQUEST®

Haldex

Fleet Solutions - Steering Gears Application Guide

2010

16 – Power Steering Gears

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Type "O" = OEM P/N, Type "S" = Service P/N

If OEM part # is not found on page listed, refer to the MCR for applicable cross reference.

PURPOSE OF THIS SECTION

This section is designed as a reference for Haldex Commercial Vehicle Systems new and remanufactured air brake system components and accessories, sold under the Haldex and Midland product names. Products described include all pertinent information needed to replace an OEM installed component or to help design an original installation. If there is a service number for a given part, it is noted in the product number table.

DESIGN FLEXIBILITY

The products presented in this section are described by function and usage. Technical data and mounting configurations are also provided. Throughout this section, reference is made to numerous specific OEM applications. This section is not, however, intended to be a mutually exclusive listing of all part numbers and designs available. Should the need for a design not presented occur, contact your Haldex Commercial Vehicle Systems sales representative for additional information.

WARRANTY INFORMATION

Proper service and repair are important to the safe, reliable operation of any motor vehicle. To prevent personal injury and/or vehicle damage, careful and cautious service procedures recommended by the vehicle manufacturer should be followed by anyone servicing a motor vehicle. For details on warranty of Haldex Commercial Vehicle air brake system components and accessories, refer to L20221 Aftermarket Warranty Policy. For warranty returns, use L90005 Warranty Adjustment Form. To obtain further information, visit the **www.haldex.com** website, select **North America/English** in drop down box then search for **Warranty**.

ORDERING PROCEDURE

Most customers can place electronic orders on the www.haldex.com website by obtaining a username and password or by using EDI. For additional information about electronic orders or to place an order by phone or fax, contact Customer Service in U.S. or Canada at numbers listed below:

U.S. Customer Service:
Phone: 800–643–2374
Fax: 800–533–1941
Mail: Commercial Vehicle Systems
Haldex Brake Products Corporation
Attn: Customer Service Department
10930 N. Pomona Ave.
Kansas City, MO 64153

Canada Customer Service:
Phone: 800–267–9247
Fax: 519–621–3924
Mail: Commercial Vehicle Systems
Haldex Limited
Canadian Distribution Centre
Attn: Customer Service Department
500 Pinebush Road, Unit 1
Cambridge, Ontario N1T 0A5

IMPORTANT NOTICE

The data listed herein is correct to the best of Commercial Vehicle Systems knowledge and belief, having been compiled from reliable and official sources of information. However, COMMERCIAL VEHICLE SYSTEMS CANNOT ASSUME ANY RESPONSIBILITY for possible error or misapplication of the product. Final determination of the suitability of the products for the use contemplated by the Buyer is the sole responsibility of the Buyer. Commercial Vehicle Systems shall have no responsibility in connection with this suitability. It is not our intention to imply that any of the components in this catalog in connection with an engine make or model are made by any engine manufacturer.

Heavy duty power steering gears have a twelve (12) month, 3,600 hour (whichever comes first) warranty. For further details, refer to L20221 Aftermarket Warranty Policy. For warranty return, use L90005 Warranty Adjustment Form.

SPECIAL NOTE

Proper service and repair is important to the safe reliable operation of all motor vehicles. Careful and cautious service procedures recommended by the manufacturers should be taken by anyone servicing a motor vehicle to minimize the risk of personal injury and vehicle damage. All information, illustrations, specifications and schematics contained in this section are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

WARNING FOR PROPER STEERING GEAR OPERATION

1. Do not weld, braze or solder any steering gear or system arm components.
2. Maximum flow under any conditions must not exceed vehicle manufacturers specifications.
3. Always inspect any steering component(s) which has been (or is suspected to have been) subject to impact. Replace any part that has been damaged or is questionable.
4. Never mix or use improper oils for units.

STEERING SYSTEM MAINTENANCE TIPS

1. Prevent internal bottoming of the steering gear. Carefully check axle stops to be sure that they meet the manufacturer's specifications.
2. Regularly check the fluid and the fluid level in the power steering reservoir.
3. Keep tires inflated to correct pressure.
4. Always use a puller, never a hammer or torch, to remove pitman arms.
5. Investigate and immediately correct the cause of any play, rattle, or shimmy in any part of the steering linkage or steering mechanism.
6. Remove the cause of steering column misalignment.
7. Encourage all drivers to report any malfunctions or accidents that could have damaged steering components.
8. Do not attempt to weld any broken steering component. Replace the component with original equipment only.
9. Do not cold straighten, hot straighten, or bend any steering system component.
10. Always clean off around the reservoir filler cap before you remove it. Prevent dirt or other foreign matter from entering the hydraulic systems.
11. Investigate and correct any external leaks, no matter how minor.
12. Replace filters and pumps in compliance with specification.
13. If extended stationary use of vehicle is developing excessive hydraulic fluid temperatures, consult vehicle manufacturer for auxiliary cooling method.
14. Maintain grease pack applied behind the input and output shaft's protector seal as a general maintenance procedure.

Light Duty Steering Gears – Remanufactured

Specifications:

Approximate Weight 30 lbs.

SKU#	Product Description	Stamped #	Casting #	Year	Type	Core Group
RG1416X	Remanufactured Light Duty Steering Gear	SPA DX	D9AC–AA	1980–1995	Ford F100–F350 Truck 2WD & 4WD	SG1101
RG1456X	Remanufactured Light Duty Steering Gear	SPA HY	3550	1997–2000	Ford F100–F350 Truck 2WD & 4WD	SG1101

Bendix® Steering Gear Kit

Product Image Not Available

SKU#	Product Description	MFG. #
RG300K	Steering Gear Kit for Bendix® Model 300	C300N–SK
RP500K	Steering Gear Kit for Bendix® Model 500	C500N–SK

Bendix® Steering Gears – Remanufactured

SKU#	Product Description	Approx. Weight	MFG. #	Casting #	Hoses	Mounting Bolts	Sector Shaft	Input Spline	OEM #	Core Group
RG22603X	Remanufactured Bendix® Model 300 Steering Gear	60 lbs.	2260377	2260377	2	3	Clamp	Flat	E8HT3N503AD	SG9000
RG22682X	Remanufactured Bendix® Model 500 Steering Gear	94 lbs.	2268244	2260351	2	3	Clamp	Flat	2268244	SG9000

Ross Steering Gears – Remanufactured

SKU#	Product Description	Approximate Weight	Manufacture Number	Core Group
RG50302X	Remanufactured Ross Manual Steering Gear	40 lbs.	503AS144	SG8001
RG50303X	Remanufactured Ross Manual Steering Gear	40 lbs.	503AS074	SG8001
RG50304X	Remanufactured Ross Manual Steering Gear	40 lbs.	503AS110	SG8001
RG50306X	Remanufactured Ross Manual Steering Gear	40 lbs.	503AS124	SG8001

Saginaw Steering Gears – Remanufactured

Features:

- **RG78131X** – Dual Piston Gear, Metric, GMC–Chev. Application
- **RG78132X** – Dual Piston Gear, GMC–Chev. Application
- **RG78133X** – Dual Piston Gear, Metric, GM Topkick Application
- **RG78303X** – Dual Piston Gear, S–Line Internationals.

Specifications:

Astro Kit	RG78001
Brigadier Kit	RG78002
Dual Kit	RG78003

Notes:

1) **RG78020X** not pictured

SKU#	Product Description	Approx. Weight	MFG. #	Casting #	Core Group
RG56906X	Reman. Saginaw Steering Gear	38 lbs.	5696067LV	5696067	SG6001
RG56907X	Reman. Saginaw Steering Gear	55 lbs.	5696067HV	5696067	SG6001
RG56908X	Reman. Saginaw Steering Gear	34 lbs.	5690653	5690653	SG6001
RG78020X	Reman. Saginaw Steering Gear	55 lbs.	7802018	7802018	SG6001
RG78131D9X	Reman. Saginaw Steering Gear – Dual Piston Gear, Metric	55 lbs.	781316M	7813161 Metric	SG6001
RG78131X	Reman. Saginaw Steering Gear – Dual Piston Gear, Metric	52 lbs.	781316M	7813161 Metric	SG6001
RG78132X	Reman. Saginaw Steering Gear – Dual Piston Gear	54 lbs.	781316MN	7813161	SG6001
RG78133X	Reman. Saginaw Steering Gear – Dual Piston Gear – Metric	60 lbs.	26002502	–	SG6004
RG78303X	Reman. Saginaw Steering Gear – Dual Piston Gear	57 lbs.	78303891	7830389	SG6001
RG78323X	Reman. Saginaw Steering Gear	37 lbs.	7832331	7832331	SG6001

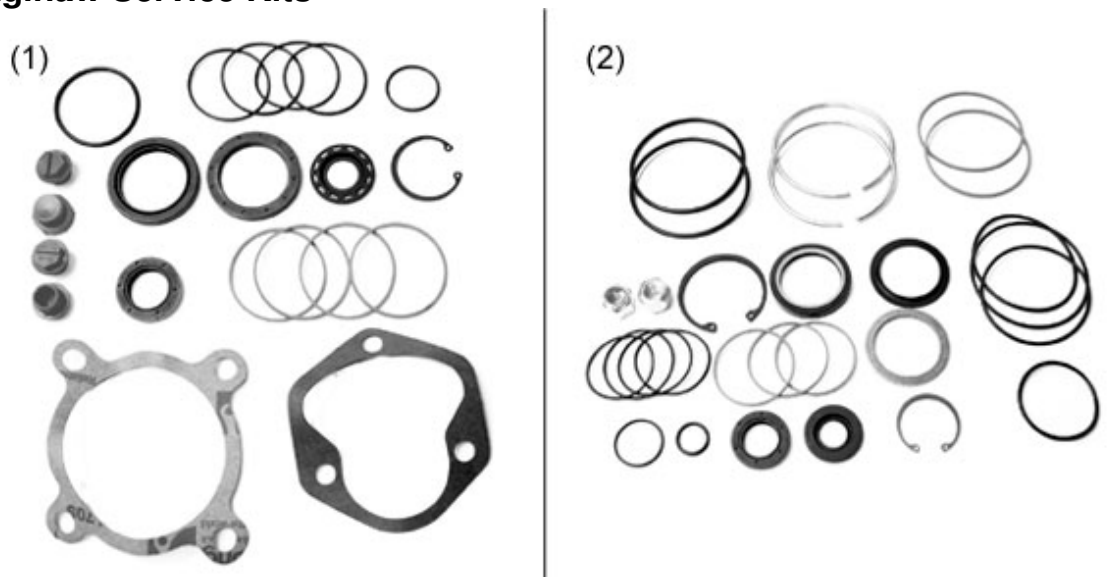
Saginaw Cylinders – Remanufactured

Features:

- Need weld to weld measurement to order correct cylinder.

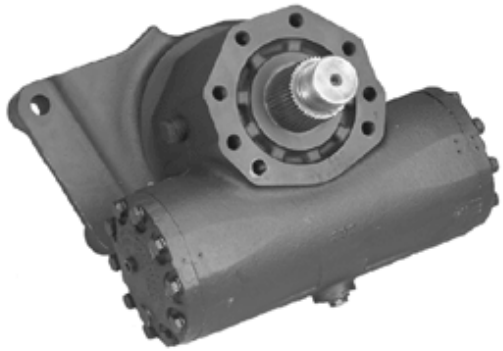
SKU#	Product Description	Application	Length	Core Group
RG40011X	Remanufactured Saginaw Cylinder	Most GMC–Chevrolet trucks with rotary valve Saginaw gears.	11"	SC1001
RG40113X	Remanufactured Saginaw Cylinder	Most GMC–Chevrolet trucks with rotary valve Saginaw gears.	13"	SC1001

Saginaw Service Kits



SKU#	Product Description	Picture Number
RG78001	Astro Service Kit for Saginaw Power Steering Gear	–
RG78002	Brigadier Service Kit for Saginaw Power Steering Gear	1
RG78003	Dual Service Kit for Saginaw Power Steering Gear	2
RG8295K	710ML Seal Kit for Saginaw Power Steering Gear	–

292 Series Steering Gears – Remanufactured



Specifications:

Shaft Diameter	2"
Seal Kit	RG29210
Approximate Weight	85 lbs.

SKU#	Product Description	Approx. Weight	MFG. #	Casting #	OEM #	Core Group
RG29202X	Remanufactured Sheppard 292 Series Steering Gear	80 lbs.	292RR2	292S–4S5	443675C92	SG7001
RG29203X	Remanufactured Sheppard 292 Series Steering Gear	88 lbs.	292BYL4	292	585922C91	SG7001
RG29204X	Remanufactured Sheppard 292 Series Steering Gear	89 lbs.	292AJL4	292S–4S–5	585922C91	SG7001
RG29205X	Remanufactured Sheppard 292 Series Steering Gear	87 lbs.	292SCA5	292S–4S6	573063C91	SG7001
RG29207X	Remanufactured Sheppard 292 Series Steering Gear	90 lbs.	292SCX6	292 S–6	15554382	SG7001
RG29208X	Remanufactured Sheppard 292 Series Steering Gear	84 lbs.	292SCA6	292 S–6	1650926C91	SG7001
RG29209X	Remanufactured Sheppard 292 Series Steering Gear	84 lbs.	292SBE5	292	594565C91	SG7001

392 Series Steering Gears – Remanufactured

Specifications:

Shaft Diameter	2"
Approximate Weight	100 lbs.
Seal Kit	RG39210

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG39201X	Reman. Sheppard 392 Series	392BR5	392	464027C92	SG7003
RG39202X	Reman. Sheppard 392 Series	392SCH4	392S–4S–6	584547C91	SG7003
RG39203X	Reman. Sheppard 392 Series	392SU4	392S–4S6	492982C92	SG7003
RG39204X	Reman. Sheppard 392 Series	392SCU4	392S	585920C91	SG7003
RG39205X	Reman. Sheppard 392 Series	392SBV4	392 S4	20QC493088P2	SG7003
RG39206X	Reman. Sheppard 392 Series	392SGA6	392S–6	14–10064	SG7003
RG39207X	Reman. Sheppard 392 Series	392SFY6	392S–6	14–10065	SG7003
RG39208X	Reman. Sheppard 392 Series	392SFZ6	392S–6	15517614J	SG7003
RG39209X	Reman. Sheppard 392 Series	392SFV4	392S–4S6	1649465C91	SG7003
RG39211X	Reman. Sheppard 392 Series	392BSL5	392 S4	464028C93	SG7003
RG39214X	Reman. Sheppard 392 Series	392SGM6	392S–4S6	14–10201	SG7003
RG39215X	Reman. Sheppard 392 Series	392CG5	392S–5	K254–201	SG7003
RG39216X	Reman. Sheppard 392 Series	392SDX6	392S–6	10–02084	SG7003
RG39217X	Reman. Sheppard 392 Series	392SGS4	392S4–5–6	1649466C91	SG7003
RG39218X	Reman. Sheppard 392 Series	392SHA4	392S–4S–6	1650932C91	SG7003
RG39220X	Reman. Sheppard 392 Series	392S5	392S–5	–	SG7003
RG39221X	Reman. Sheppard 392 Series	392SCB4	392S	B14–9921–0	SG7003

492 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight 128 lbs.

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG49201X	Reman. Sheppard 492 Series	492SHM6–X3	–	–	SG4001
RG49206X	Reman. Sheppard 492 Series	492SF	–	–	SG4001
RG49207X	Reman. Sheppard 492 Series	492SDW	–	–	SG4001

592 Series Steering Gears – Remanufactured

Specifications:	
Approximate Weight	189 lbs.
Seal Kit	RG59210

SKU#	Product Description	MFG. #	Casting #	OEM Number	Core Group
RG59204X	Remanufactured Sheppard 592 Series Steering Gear	592SV5	592S–5	20QC522	SG7003

M80, M90, M100 Series Steering Gear – Remanufactured

Specifications:

Sector Shaft	4.75 Tapered Bolt with Washer
Approximate Weight	95 lbs.

SKU#	Product Description	Stamped Number	Casting Number	OEM Number	Core Group
RG100APHEX	Reman. Sheppard M100 Series	PHE	M100 Auto	3519043C91	SG9000
RG100PAEX	Reman. Sheppard M100 Series	PAE	M100	10–02155	SG4001
RG100PAGX	Reman. Sheppard M100 Series	PAG1	M100	1677448C91	SG4001
RG100PAHX	Reman. Sheppard M100 Series	PAH1	M100	1657435C91	SG4001
RG100PAMX	Reman. Sheppard M100 Series	PAM	M100	1654317C91	SG4001
RG100PBWX	Reman. Sheppard M100 Series	PBW	M100	14–100301	SG4001
RG100PBYX	Reman. Sheppard M100 Series	PBY	M100	14–103340	SG4001
RG100PBZX	Reman. Sheppard M100 Series	PBZ	M100	14–103360	SG4001
RG100PCLX	Reman. Sheppard M100 Series	PCL	M100	1659881C91	SG4001
RG100PCNX	Reman. Sheppard M100 Series	PCN	M100	667306C91	SG4001
RG100PCPX	Reman. Sheppard M100 Series	PCP	M100	1667537C91	SG4001
RG100PCRX	Reman. Sheppard M100 Series	PCR	M100	1669028C91	SG4001
RG100PCXX	Reman. Sheppard M100 Series	PCX	M100	–	SG9000
RG100PDJX	Reman. Sheppard M100 Series	PDJ	M100	–	SG4001
RG100PDKX	Reman. Sheppard M100 Series	PDK	M100	20QC381M5	SG4001
RG100PDLX	Reman. Sheppard M100 Series	PDL	M100	–	SG4001
RG100PDQX	Reman. Sheppard M100 Series	PDQ	M100	–	SG4001
RG100PENX	Reman. Sheppard M100 Series	PEN	M100	14–10337–000	SG4001
RG100PETX	Reman. Sheppard M100 Series	PET	M100	–	SG4001
RG100PFSX	Reman. Sheppard M100 Series	PFS	M100	–	SG4001
RG100PGEX	Reman. Sheppard M100 Series	PGE	M100	14–12740–000	SG4001
RG100PHDX	Reman. Sheppard M100 Series	PHD	M100	3501229C91	SG9000
RG100PHEX	Reman. Sheppard M100 Series	PHE	M100	3501032C91	SG4001
RG100PJBX	Reman. Sheppard M100 Series	PJB	M100	8084060	SG4001
RG100PJCX	Reman. Sheppard M100 Series	PJC	M100	–	SG4001
RG100PJGX	Reman. Sheppard M100 Series	PJG	M100	–	SG4001
RG100PJHX	Reman. Sheppard M100 Series	PJH	M100	–	SG4001
RG100PLTX	Reman. Sheppard M100 Series	PLT	M100	–	SG9000
RG100PLXX	Reman. Sheppard M100 Series	PLX	M100	9002–8283	SG4001
RG100PMXX	Reman. Sheppard M100 Series	PMX	M100	3501032C91	SG9000

RG100PNJX	Reman. Sheppard M100 Series	PNJ	M100	–	SG4001
RG100PPFX	Reman. Sheppard M100 Series	PPF	M100	–	SG4001
RG100PQFX	Reman. Sheppard M100 Series	PQF	M100	–	SG4001
RG100PQQX	Reman. Sheppard M100 Series	PQQ	M100	–	SG4001
RG80SAAX	Reman. Sheppard M80 Series	SAA	M80	1664771C91	SG9000
RG80SADX	Reman. Sheppard M80 Series	SAD	M80	1667449C91	SG9000
RG90PAEX	Reman. Sheppard M90 Series	PAE1	M90	1664770C91	SG9000

Sheppard Service Kits

SKU#	Product Description	Picture
RG100K	Complete Seal Kit for Sheppard M–100 Series Power Steering Gear	–
RG29210	Seal Kit for Sheppard 292 Series Power Steering Gear	1
RG39210	Seal Kit for Sheppard 392 Series Steering Gear	2
RG49210	Seal Kit for Sheppard 492 Series Steering Gear	3
RG59210	Seal Kit for Sheppard 592 Series Steering Gear	–
RG90K	Seal Kit for Sheppard M–90 Series Power Steering Gear	–
RGM100K	Minor Seal Kit for Sheppard M–100 Series Power Steering Gear	–

HF54 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight	60 lbs.
Seal Kit	RG54001

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG54039X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54039	HF542995	402062C93	SG1001
RG54042X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54042	HF542998	DOTZ3504C	SG1001
RG54043X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54043	HF542996	DOHZ3504K	SG1001
RG54044X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54044	HF542998	DOTZ3504A	SG1001
RG54050X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54050	HF542996	DOHZ3504J	SG1001
RG54053X	Remanufactured TRW/Ross HF54 Series Steering Gear	HF54053	HF542997	442783C95	SG1001

HF64 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight	84 lbs.
Seal Kit	RG64001

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG64076X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64076	HF642990	D1HZ3504F	SG2001
RG64077X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64077	HF642990	D1HZ3504E	SG2001
RG64107X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64107	HF642988	402061C93	SG2001
RG64113X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64113	HF642989	20QC4290P2	SG2001
RG64114X	Remanufactured TRW/Ross HF64 Series Steering Gear	HFB64114	HFB642997	20QC4290P1	SG2001
RG64119X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64119	HF642989	20QC49307	SG2001
RG64122X	Remanufactured TRW/Ross HF64 Series Steering Gear	HF64122	HF642990	E1HZ3504A	SG2001

HFB52 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight	67 lbs.
Seal Kit	RG52001

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG52013X	Remanufactured TRW/Ross HFB52 Series Steering Gear	HFB52991	HFB52991	496785C91	SG3002
RG52017X	Remanufactured TRW/Ross HFB52 Series Steering Gear	HFB52017	HFB52299	E1HZ3504H	SG3001
RG52023X	Remanufactured TRW/Ross HFB52 Series Steering Gear	HFB52023	HFB522987	E1HZ3504M	SG3001
RG52033X	Remanufactured TRW/Ross HFB52 Series Steering Gear	HFB52033	HFB522991	1656618C91	SG3001

HFB64 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight	85 lbs.
Seal Kit	RG64002

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG64032X	Reman. TRW/Ross HFB64 Series	HFB64032	HFB642987	5004439C92	SG4001
RG64033X	Reman. TRW/Ross HFB64 Series	HFB64033	HFB642996	B14099190 B149919	SG4001
RG64042X	Reman. TRW/Ross HFB64 Series	HFB64042	2994	E3HZ3504A	SG4001
RG64045X	Reman. TRW/Ross HFB64 Series	HFB64045	HFB642989	585777C91	SG4001
RG64047X	Reman. TRW/Ross HFB64 Series	HFB64047	HFB642987	584539C91	SG4001
RG64052X	Reman. TRW/Ross HFB64 Series	HFB64052	HFB642945	E2HT3N503BA	SG4001
RG64055X	Reman. TRW/Ross HFB64 Series	HFB64055	HFB642976	20QC4294A	SG4001
RG64057X	Reman. TRW/Ross HFB64 Series	HFB64057	HFB642988 RH	475179C93	SG4001
RG64079X	Reman. TRW/Ross HFB64 Series	HFB64079	HFB642978	E2HT3N503AA	SG4001
RG64083X	Reman. TRW/Ross HFB64 Series	HFB64083	HFB642953	1002064	SG4001
RG64085X	Reman. TRW/Ross HFB64 Series	HFB64085	HFB642985	K254–218	SG4001
RG64086X	Reman. TRW/Ross HFB64 Series	HFB64086	HFB642964	584539C91	SG4001
RG64098X	Reman. TRW/Ross HFB64 Series	HFB64098	HFB642960	2901161330 Bluebird	SG4001
RG64128X	Reman. TRW/Ross HFB64 Series	HFB64128	–	–	SG4001

HFB70 Series Steering Gears – Remanufactured

Specifications:

Approximate Weight	110 lbs.
Seal Kit	RG70001

SKU#	Product Description	MFG. #	Casting #	OEM #	Core Group
RG70014X	Remanufactured TRW/Ross HFB70 Series Steering Gear	HFB70014	HFB702883	383010002 383010003	SG5001
RG70045X	Remanufactured TRW/Ross HFB70 Series Steering Gear	HFB70045	HFB702993	383010006	SG5001
RG70049X	Remanufactured TRW/Ross HFB70 Series Steering Gear	HFB70049	HFB702931	28QC49309	SG5001
RG70065X	Remanufactured TRW/Ross HFB70 Series Steering Gear	HFB70065	HFB702992	K254206 6990–HFB70065	SG5001
RG70114X	Remanufactured TRW/Ross HFB70 Series Steering Gear	HFB70114	–	–	SG5001

TAS Series Steering Gears – Remanufactured

Specifications:

Seal Kit	RG65000
Approximate Weight	85 lbs.

SKU#	Product Description	Manufacture Number	Casting Number	OEM Part Number	Core Group
RG40001X	Reman. TAS Series	TAS40001	TAS402299	1688582C91	SG4001
RG40005X	Reman. TAS Series	RCS40005	–	–	SG4001
RG40006X	Reman. TAS Series	TAS40006	TAS402299	16885882C91	SG4001
RG55001X	Reman. TRS Series	TAS55001	TAS552299	1661401C91	SG4001
RG55003X	Reman. TAS Series	TAS55003	TAS552298	680 460 0001	SG4001
RG60009X	Reman. TAS Series	THP60009	THP602296	20511466	SG4001
RG65001X	Reman. TAS Series	TAS65001	TAS652299	1659069C91	SG4001
RG65004X	Reman. TAS Series	TAS65004	TAS652295	14–10053–000	SG4001
RG65005X	Reman. TAS Series	TAS65005	TAS652293	14–100520	SG4001
RG65006X	Reman. TAS Series	TAS65006	TAS652296	3047087	SG4001
RG65007X	Reman. TAS Series	TAS65007	TAS652294	K294–194	SG4001
RG65008X	Reman. TAS Series	TAS65008	TAS652292	K254–218	SG4001
RG65010X	Reman. TAS Series	TAS65010	TAS652291	F2HZ3504F	SG4001
RG65012X	Reman. TAS Series	TAS65012	TAS652290	20QC535AM	SG4001
RG65014X	Reman. TAS Series	TAS65014	TAS652295	38301–3409	SG4001
RG65015X	Reman. TAS Series	TAS65015	TAS652289	1161330	SG4001
RG65024X	Reman. TAS Series	TAS65024	TAS652292	10–02379	SG4001
RG65025X	Reman. TAS Series	TAS65025	TAS652286	10–02064	SG4001
RG65026X	Reman. TAS Series for GMC Top Kick	TAS65026	TAS652288	15651116	SG4001
RG65042X	Reman. TAS Series	TAS65042	TAS652282	1663200C91	SG4001
RG65047X	Reman. TAS Series	TAS65047	TAS652291	FOHT3N503BA	SG4001
RG65048X	Reman. TAS Series	TAS65048	TAS652291	F1HT3N503EA	SG4001
RG65065X	Reman. TAS Series	TAS65065	TAS652279	F3HT3N503AC	SG4001
RG65070X	Reman. TAS Series	TAS65070	TAS652291	F2HZ3504E	SG4001

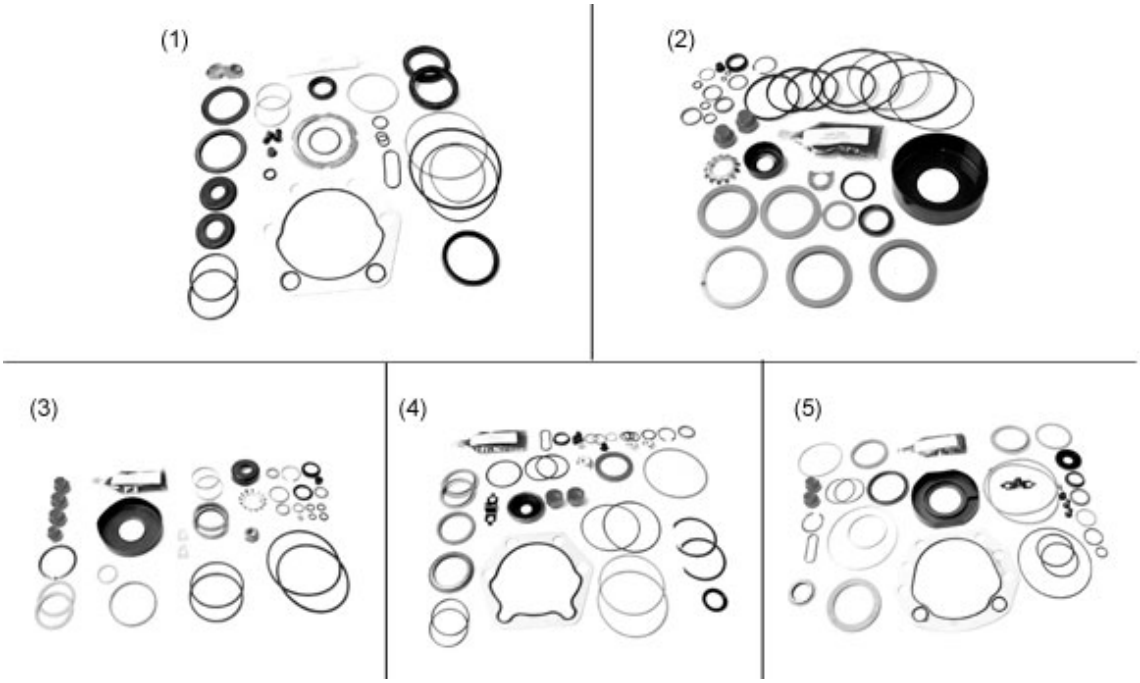
RG65071X	Reman. TAS Series	TAS65071	TAS652291	F7HZ3504G	SG4001
RG65079X	Reman. TAS Series	TAS65079	TAS652296	–	SG4001
RG65085X	Reman. TAS Series	TAS65085	TAS652289	–	SG4001
RG65090X	Reman. TAS Series for Kenworth	TAS65090	TAS652274	K294–194	SG4001
RG65092X	Reman. TAS Series	TAS65092	TAS652290	20QC535AM	SG4001
RG65101X	Reman. TAS Series	TAS65101	TAS652278	F5HZ3504C	SG4001
RG65102X	Reman. TAS Series	TAS65102	TAS652295	90022655	SG4001
RG65104X	Reman. TAS Series	TAS65104	TAS652268	F6HZ3504BC	SG4001
RG65105X	Reman. TAS Series	TAS65105	TAS652267	F6HZ3504DB	SG4001
RG65119X	Reman. TAS Series	TAS65119	TAS652262	14–12475–000	SG4001
RG65122X	Reman. TAS Series	TAS65122	TAS652269	F6HT3504KA	SG4001
RG65127X	Reman. TAS Series	TAS65127	TAS652261	–	SG4001
RG65129X	Reman. TAS Series for Freightliner	TAS65129	TAS652262	14–12475–000	SG4001
RG65133X	Reman. TAS Series	TAS65133	TAS652296	–	SG4001
RG65142X	Reman. TAS Series	TAS65142	TAS652290	20QC535AM	SG4001
RG65150X	Reman. TAS Series for Volvo	TAS65150	TAS652265	3098661	SG4001
RG65155X	Reman. TAS Series for Freightliner	TAS65155	TAS652262	14–13451–000	SG4001
RG65166X	Reman. TAS Series	TAS65166	TAS652295	38301–3409	SG4001
RG65218X	Reman TAS Series	TAS65218	TAS652249	20518924	SG4001
RG85002X	Reman. TAS Series	TAS85002	TAS852298	38301–3419	SG8501
RG85024X	Reman. TAS Series	TAS85024	–	38301–0007	SG8501
RG85134X	Reman. TAS Series	TAS85134	TAS852276	14–14955–001	SG8501

TRW/Ross Cylinders – Remanufactured

Product Image Not Available

SKU#	Product Description	Length	Core Group
RG40112X	Remanufactured TRW/Ross Cylinder	12"	SC1002

TRW/Ross Service Kits



SKU#	Product Description	Picture Number
RG52001	TRW/Ross HFB52 Series Steering Gear Seal Kit	4
RG54001	TRW/Ross HF54 Series Steering Gear Seal Kit	3
RG64001	TRW/Ross HF64 Series Steering Gear Seal Kit	2
RG64002	TRW/Ross HFB64 Series Steering Gear Seal Kit	–
RG65000	TRW/Ross TAS Series Steering Gear Seal Kit	1
RG70001	TRW/Ross HFB70 Series Steering Gear Seal Kit	5
RG8101K	TRW/Ross TAS 65 Series Steering Gear Seal Kit	–
RG8103K	TRW/Ross TAS 85 Series Steering Gear Seal Kit	–
RG8800SK	TRW/Ross TAS Series Steering Gear Shaft	–

OIL SPECIFICATIONS

Ford Bendix C–300N
Motorcraft – Marcon
Multi–Purpose ATF XT–2–QDX or DDX (ESP–M2C166–H)
or Equivalent

Ross HF54 & HF64 ATF "E" or "F"
Ford Spec. M2C138CJ
ATF Dexron 2
Shell Rotella T.....SAE 30
Mobile.....SAE 10W30
Mobile.....SAE 10W40
Ashland.....SAE 10W40
Union.....SAE 10W40
Texaco.....SAE 10W40

Ross HFB52
ATF "E" or "F"
Ford Spec. M2C138CJ
ATF Dexron 2
Mack EO–K2 Engine Oil
Shell Rotella T.....SAE 30
Mobile.....SAE 10W30
Mobile.....SAE 10W40
Ashland.....SAE 10W40
Union.....SAE 10W40
Texaco.....SAE 10W40
Unical Gaurdol.....SAE 15W40
Unical Gaurdol.....SAE 30
Essolube.....SAE 15W40
Chevron.....SAE 15W40

Ross HFB64 & HFB70
ATF "E" or "F"
Ford Spec. M2C138
ATF Dexron 2
Mack EO–K2 Engine Oil
Shell Rotella T.....SAE 30
Mobile.....SAE 10W30
Mobile.....SAE 10W40
Ashland .....SAE 10W40
Union.....SAE 10W40
Texaco.....SAE 10W40
Unical Gaurdol.....SAE 15W40
Unical Gaurdol.....SAE 30
Essolube.....SAE 15W40
Chevron.....SAE 10W40

M–Sheppard (M80, M90, M100 & M110)
15W40 Motor Oil
ATF Dexron 2
GM Power Steering Fluid
Hydraulic Fluid
Sheppard 292, 392, 492 & 592 Series
10W40 (API SD–SE) Motor Oil is Preferred
ATF
GM Power Steering Fluid
Hydraulic Fluid
Dexron 2

ALL Power Steering Pumps
See Vehicle Manufacturer's Recommendations.

NOTE: The filter element should always be changed when the oil in the steering system is changed or a unit is changed.
WARNING: Completely flush the system with recommended fluid only. Do not mix oil types. Any mixture or any unapproved oil could lead to seal deterioration and leaks. A leak could ultimately cause the loss of fluid, which could result in loss of power steering assist.

OPERATING PRESSURE & OIL FLOW

Ross HF54 Series
Maximum operating pressure is 1500 PSI
Maximum flow rate is 6 GPM
NOTE: The recommended minimum flow at 1 1/2 hand wheel turns must be no more than 2.5 GPM. If the HF54 gear is operating an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Ross HFB52 Series
Maximum operating pressure is 2000 PSI
Maximum flow rate is 6 GPM
NOTE: The recommended minimum flow at 1 1/2 hand wheel turns must be no less than 2 GPM. If the HFB52 steering gear is controlling an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Ross HFB70 Series
Maximum operating pressure is 2000 PSI
Maximum flow rate is 8 GPM
NOTE: The recommended minimum flow at 1 1/2 hand wheel turns must be no less than 3.4 GPM. If the HFB70 is controlling an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Ross HF64 Series
Maximum operating pressure is 1750 PSI
Maximum flow rate is 8 GPM
NOTE: The recommended minimum flow at 1 1/2 hand wheel turns must be no less than 3.4 GPM. If the HFB70 is gear is operating an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Ross HFB64 Series
Maximum operating pressure is 2000 PSI
Maximum flow rate is 6 GPM
NOTE: The recommended minimum flow at 1 1/2 hand wheel turns must be no less than 2.9 GPM. If the HFB52 steering gear is controlling an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Ross TAS40, 55 & 65 Series
Maximum operating pressure is 2175 PSI
Maximum flow rate is 7 GPM
NOTE: The recommended minimum flow at 1 1/2 steering wheel turns per second is as follows: TAS40no less than 2.2 GPM. TAS55no less than 2.6 GPM. TAS65 no less than 3.0 GPM. If the gear controlling an assist cylinder, more flow may be required based on size of cylinder and front axle weight.

Whenever steering complaints are encountered it is important that the complete steering system be inspected. Special body or equipment installations should also be considered for their affect on steering performance.

The steering system consists of the Sheppard Integral Power Steering Gear, a hydraulic supply pump with pressure and flow controls and an oil reservoir, the front axle and mechanical components and the steering column or input shaft and connecting linkages, The front tires and wheels must also be considered as part of the total steering system.

Steering performance can be affected by out of line conditions anywhere in the total steering system. Other factors outside the steering system can also contribute to poor steering performance.

Many times a steering gear is removed and disassembled needlessly, because an organized diagnosis procedure has not been followed. Start your diagnosis by:

- **Defining The Complaint**

    1. Talk to and question the driver
    2. Drive the vehicle

- **Visual Inspection**

    1. Look for poor loading practices
    2. Check tires for mismatch and proper air pressure
    3. Check for dry fifth wheel or improper location
    4. Check suspension for sagging or shifting (out of line rear axles will tend to steer the front end of the vehicle)

- **Mechanical Components Inspection**

    1. Check all front axle components for wear, excessive slack, or seizure
    2. Inspect front and rear suspension components
    3. Check steering gear mounting to be sure it is tight and not shifting on the chassis or axle
    4. Inspect steering column components

- **Hydraulic Supply System Inspection**

    Evaluate hydraulic supply system performance. Follow procedures in "Hydraulic Supply–Diagnosis" section. Oil pressure and oil flow must be within the vehicle manufacturer's specification.

The following pages list possible symptoms, causes and corrective action for steering system complaints. Careful and complete diagnosis will enable you to solve steering problems quickly.

NOTE: Keep in mind that the same problems that upset manual steering will also affect power steering.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Oil leaking at output shaft of steering gear	Damaged sector shaft seal Clogged oil filter in reservoir (high back pressure) Pinched or restricted oil return line Damaged quad ring seal Damaged bronze bearings Damaged lipseal (Series 5 gears) Damaged roller bearings	Replace sector shaft seal Replace filter Increase change frequency Locate and correct Check back pressure Replace quad ring seal Replace bronze bearings Polish output shaft or replace to remove bronze deposits Replace with replacement seal assy. Replace roller bearings Polish output shaft or replace to remove pitting & grooving in seal area
Oil leaking at actuating shaft of steering gear	Worn or damaged oil seal Damaged actuating shaft seal surface	Replace seals Replace damaged ports Lube bearing cap more often
Oil leaking at supply pump drive shaft	Damaged oil seal Oil seal–heat damaged Loose or damaged bushing on pump drive shaft	Replace oil seal Check operating temperature Repair pump per pump service instructions
Oil leaking between reservoir and pump body	Seal or gasket damaged	Replace damaged parts
Lubricant milky or white in appearance	Water entry through reservoir venting system	Clean vent system or replace cap assembly
Oil forced out of reservoir or foaming	Clogged oil filter Loose pump drive belts Air in system Faulty supply pump (Cavitation) Relief plungers of steering gear not adjusted properly Operating temperatures too high	Change oil and oil filter Increase change intervals Adjust belts or replace Bleed air from system Check for air leak on suction side of supply pump Check supply pump following "Hydraulic Supply–Diagnosis" procedures Repair pump per pump service instructions Adjust relief plungers (see Final Adjustments) Follow "Hydraulic Supply–Diagnosis" procedures
Engine oil in power steering reservoir (Gear driven pump)	Faulty seal at pump drive shaft Faulty seal at accessory shaft driving supply pump	Repair pump Repair accessory drive
Lubricating oil discolored or smells bad	Operating temperatures too high Change intervals too long Incorrect lubricant used	Check and correct cause of over–heating Increase oil change frequency Drain, flush and refill with 10W40 motor oil
High operating temperatures	Oil flow restriction Oil flow too high	Check back pressure (Follow "Hydraulic Supply–Diagnosis" procedures) Check maximum oil flow (follow "Hydraulic Supply–Diagnosis" procedures)

SYMPTOM	POSSIBLE CAUSE	REMEDY
Oil in reservoir foaming	Air leak in suction side of supply pump Pump cavitating Oil overheating Incorrect lubricant	Refer to pump servicing instructions Check for restriction in pump supply See high operating temperatures Change to 10W40 motor oil
No power steering on cold start	Hydraulic supply pump vanes not extending (Vane type pump only)	Increase engine speed momentarily to extend vanes and start pump action. Usually a temporary and infrequent occurence and not cause for pump repair or replacement
Excessive pump pressure with steering gear in neutral position	Pinched oil return line High back pressure Binding steering column Damaged actuating shaft bearing	Relocate line Repair steering column Replace damaged parts as required
Wheel cuts restricted	Relief plungers misadjusted	Adjust relief plungers (See Final Adjustments section)
Erratic steering or mechanical steering only	Insufficient volume of oil being metered by flow divider to steering gear induced by foreign particles on flow divider valve, causing the valve to hang up in the bore	Polish flow divider valve to remove foreign particles and burrs
Hard steering	Loose belts Worn pully(s) due to belt slipping Faulty supply pump Front axle overloaded Faulty steering geometry High operating temperature	Tighten or replace belts Replace pully(s) and belts (keep belt tight) Follow "Hydraulic Supply–Diagnosis" procedures Correct loading practices Align front end Locate and correct cause of overheating
Wheel turns hard in one or both directions	Bent or damaged king pins and tie rods Front end load too great for rated axle capacity Fatigued by–pass valve spring in pump Low oil level in steering system Air in system Metal or foreign material caught in actuating valve Actuating valve worn or chipped by dirt	Repair or replace king pins and tie rods Lighten load or install larger steering gear Replace with flow control valve pump assembly Fill oil reservoir as required Bleed system and check for cause of air (See Final Adjustments Section) Remove actuating valve Clean and check parts for damage If damage is excessive replace damaged parts as required.
Wheel steering hard in one direction	Broken reversing springs in steering gear Metal or foreign material in relief ball seat in piston of steering gear Foreign material in relief valve	Replace reversing springs and damaged parts Remove piston and clean relief valve seats or replace damaged parts Clean relief valve
Steering extremely light in one or both direction(s)	Bent or damaged reversing springs	Check for impact or accident damage Replace damaged parts

SYMPTOM	POSSIBLE CAUSE	REMEDY
Steering input not smooth (seizing, binding)	Worn universal joint Lack of lubrication Universal joint not phased properly Low oil flow Pump cavitating Overheating	Check and replace as required Lubricate per vehicle manufacturer's recommendations See NOTE: Universal Joints below Idle speed too slow Drive belts slipping Supply pump not to specifications (See "Hydraulic Supply–Diagnosis" procedures Correct pump supply Correct cause of overheating
Darting, wandering (oversteering)	Oil flow too high Air trapped in steering gear Looseness, worn front end parts Front end alignment not correct Radial tire sidewall flex Excessive wear or damage in steering gear Overloading Steering column universal joint phasing incorrect Mechanical bind in steering gear Tight tie rod ends & drag link sockets	Supply pump not to specifications (See "Hydraulic Supply–Diagnosis" Procedures) Bleed system (See Final Adjustments Section) Check and repair as required Align front end Caster Check tire pressure Check for out of line tread Contact tire manufacturer representative Check and repair as required Reduce loads See NOTE: Unviersal Joints below Check steering gear mounting for distortion Check for damaged or distorted steering gear components Check rotational torque & replace if necessary
Excessive backlash	Worn universal joint Worn pins and keys universal joint to actuating shaft and universal to steering shaft Low oil volume Pitman arm ball worn "egg–shaped" Improperly adjusted drag link, pitman arm to drag link and steering arm to drag link Loose bracket frame to bracket or bracket to gear bracket	Replace universal joint Replace pins and keys Check flow divider and pump drive Replace pitman arm assembly where riveted ball is used or only where bolted ball is used (vertical socket) Adjust drag link, drag link to pitman arm and drag link to steering arm Remove bracket, clean frame and bracket Check radius of frame making sure is not bearing on radius surface Check bracket for wear from working Replace bracket and tighten to recommended torque rating according to size and grade of bolts If necessary, replace bracket with new one

NOTE: Universal Joints

Universal joints are designed to operate best when the angle between the drive and driven shafts is a maximum of 20 to 25 degrees. Angles greater than this will cause undesirable velocity changes between the two shafts. this velocity change may upset steering performance. When two universal joints are used, it is in most instances possible to phase the two joints to match a high and low velocity in a manner that will provide equal velocity between the drive and driven shafts. A third universal joint in the shaft arrangement can upset the phasing of the first two joints and it is important that this third joints operating angle is limited to a maximum of 20–25 degrees.

Phasing of the universal joints in the steering column can be checked quite easily. Using an inch–pound graduated dial reading type torque wrench, read the variation in the torque reading while steering from lock–to–lock, with a socket on the steering shaft nut under the horn button. Variation of more than 15 in.–lb. indicates improper phasing. This reading is taken with the vehicle stationary and the engine running.

Phasing can usually be accomplished by rotating the two piece intermediate shaft one spline at a time until the torque reading remains the same all the way around the 360 degree rotation of the steering wheel.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Rack on piston damaged	Replace parts as required	
	Damaged pinion gear on output shaft	Replace pinion gear
	Damaged output shaft splines	Replace output shaft
	Worn output shaft bushings	Replace bushings and polish shaft to remove bronze deposits
	Worn pitman arm splines	Replace worn parts
	Worn actuating shaft and valve threads	Replace worn parts as required Follow "Hydraulic Supply–Diagnosis" procedures to locate cause of wear
	Free play in miter gears of angle drive	Remove miter gear housing shims to mesh gears
	Damaged reversing springs	Check and repair as required
	Universal joint yoke loose on actuating shaft	Repair or replace damaged parts, check for spline wear
No attempt to return straight ahead from turns	No positive caster	Set to 4" to 6" positive caster
	Steering column bind	Check and repair universal joints and support bearings
	Steering gear mounting distorted	Shim mounting pads to correct piston to bore interference
	Linkage ball sockets seized or binding	Check and repair or replace
	King pins seized or binding	Repair or replace
	Knuckle clearance misadjust	Adjust clearance to specifications
	Oil flow rate incorrect	Check and correct supply pump or controls

NOTE: Thread Wear
Acme thread wear generally comes from inadequate lubrication or excessive manual steering of the vehicle. Manual steering results from inadequate pump pressure or flow, or an overloaded front axle where you need steering forces in excess of the hydraulic design of the steering gear.

NOTE: Freeplay
The movement of the shuttle type actuating valve within the piston, along with the normal clearances required between operating parts in the steering gear will produce a certain amount of unresponsive motion at the rim of the steering wheel. This unresponsive motion is inherent to the design and must be considered normal. With recent advances in technology and manufacturing methods it has been possible to considerably reduce the amount of this unresponsive motion. Steering gears in service prior to July 1978 could be expected to have 3 1/2 to 4 inches unresponsive motion. Current production Sheppard steering gears in service will have 1 1/2 to 2 1/2 inches of unresponsive motion. Various combinations of steering gear ratios and steering wheel diameters could effectively reduce these maximum allowances. Nominal unresponsive motion in Series 6 steering gears, measurable at 1/2 to 1 1/2 inches. Unresponsive motion is measured at the rim of the steering wheel. It must, therefore, be noted that any freeplay in the steering column and related components will affect your measurements. The steering gear mounting must be tight and steering linkage wear adjusted out or worn parts replaced. The vehicle should be standing on a smooth shop floor with the engine idling when unresponsive motion is checked. Measurement is made at the rim of the steering wheel, from initial tire and wheel movement left steer, to initial tire and wheel movement right steer.

1. **Normal Noises**
   - ♦ You or the driver may hear a hissing noise from the control valve when it is actuated during a steering maneuver
   - ♦ You or the driver may hear a noise as fluid bypasses through the poppets at full turn
   - ♦ You or the driver may hear a noise from the system relief valve when it is required to actuate
   - ♦ You or the driver may hear pump growl from some types of power steering pumps

2. **Abnormal Noises**
   - ♦ If the power steering pump is belt driven, a squealing noise may indicate that the belts should be tightened or replaced
   - ♦ A clicking noise heard during a turn, or when changing directions, may indicate that some component is loose and shifting under load
   - ♦ A Change in the normal noise of the pump may indicate that air has been induced into the system or that fluid level is low

3. **Possible Steering Problems and Causes Road Wander**
   - ♦ Tire pressure incorrect or unequal left to right
   - ♦ Components in steering linkage loose or worn (Steering wheel to road wheel)
   - ♦ Wheel bearings improperly adjusted or worn
   - ♦ Front end alignment out of specification
   - ♦ Dry fifth wheel or poor finish on fifth wheel or trailer plate
   - ♦ Steering gear mounting bolts loose on frame
   - ♦ Steering gear improperly adjusted
   - ♦ Looseness in rear axle assemblies or trailer bogies

No Recovery
   - ♦ Tire pressure low
   - ♦ Front end components binding
   - ♦ Front end alignment incorrect
   - ♦ Tight front axle king pins
   - ♦ Dry fifth wheel or poor finish on fifth wheel or trailer plate
   - ♦ Steering column binding
   - ♦ Pump flow insufficient
   - ♦ Steering gear improperly adjusted
   - ♦ Steering gear control valve spool sticking

Shimmy
   - ♦ Badly worn or unevenly worn tires
   - ♦ Improperly mounted tire or wheel
   - ♦ Wheel bearings improperly adjusted or worn
   - ♦ Components in steering linkage loose or worn
   - ♦ Wheels or brake drums out of balance
   - ♦ Front end alignment incorrect
   - ♦ Air in the hydraulic system

3. Possible Steering Problems and Causes, continued

External Oil Leakage

- Finding the location of a leak may be difficult, since oil may run away from the leak source, the fittings, hoses, pump, or gear to a low point on the gear or chassis
- A leak from the vent plug at the side cover indicates failure of the sector shaft oil seal inside the side cover

Oversteering or Darting

- Dry fifth wheel or poor finish on fifth wheel or trailer plate
- Front end components binding or loose
- Steering gear improperly adjusted
- Steering gear control valve spool sticking
- Rear axle mounts (rear steer)

High Steering Effort in One Direction

- Unequal tire pressure
- Vehicle overloaded
- Inadequate hydraulic system pressure
- Excessive internal leakage in one direction of turn only (verify with internal leakage test)

High Steering Effort in Both Directions

- Low tire pressure
- Vehicle overloaded
- Low hydraulic fluid level
- Low pressure or flow from pump
- Components of steering system binding
- Restriction in return line, or line too small in diameter
- Excessive internal leakage (verify with internal leakage test)
- Oversized tires (check manufacturer's specifications)

Lost Motion (Lash) at the Steering Wheel

- Steering wheel loose on the shaft
- Loose connection between the steering gear, intermediate column, and steering column
- Steering gear loose on frame
- Pitman arm loose on output shaft
- Components in steering linkage loose or worn
- Steering gear improperly adjusted

Excessive Heat [150F (65.6C) Over Ambient]

- Excessive pump flow
- Vehicle overloaded
- Undersized replacement hose or line
- Restricted hose or line that is kinked or severely bent or internally blocked
- Restricted recentering of gear valve caused by column bind or side load on the input shaft
- Poppet not adjusted properly
- Prolonged stationary vehicle operation

WARNING: IF THE HYDRAULIC SYSTEM FLUID BECOMES OVERHEATED, IT CAN CAUSE THE SEALS IN THE STEERING GEAR AND PUMP TO SHRINK, HARDEN, OR CRACK AND LOSE THEIR SEALING ABILITY.

4. **Filling and Air Bleeding The System**
CAUTION: For steps 1 and 2, do not turn the steering wheel. Otherwise, air may be induced into the system.

Step 1.
Fill the reservoir nearly full. Crank the engine for 10 seconds without, if possible, allowing it to start. If the engine does start, shut it down immediately. Check and refill the reservoir. Repeat at least three times, each time checking and refilling the reservoir.

CAUTION: Do not allow the fluid to drop significantly or run out of the reservoir. This may induce air into the system.

Step 2.
Start engine and let it idle for 2 minutes. Shut the engine off and check the fluid level in the reservoir.

Step 3.
Start the engine again. Steer the vehicle from full left to full right several times. Add fluid, as necessary, to the fill line on the dipstick.

NOTE: Poppets, equipped on the gear, must be adjusted so that they relieve pressure at the full left and right turns to aid in the removing of air from the system. At this time, make sure any poppets are properly adjusted. If they are not, adjust them according to specifications in the TRW gear manual.

The above procedures should remove all the air from the steering system, unless the gear is mounted in an inverted position and is equipped with the manual bleed screw. If this is so refer to Step 4.

Step 4.
Remove the air from a gear mounted in an inverted position and equipped with a manual bleed screw by following steps 1, 2 and 3 above. Then, with the engine idling, steer the gear from full left to full right several times. Loosen the manual bleed screw about one turn, with the steering gear in neutral **(no steering action)**, allowing air and aerated fluid to "bleed out" around the bleed screw until only clear **(non aerated)** fluid is bleeding out then close the bleed screw. 4/16" socket required. Check and refill reservoir.

Repeat this procedure 3 or 4 times starting with the steering maneuver with bleed screw closed, until only clear (non aerated) fluid is discharged when bleed screw is loosened. Torque the manual bleed screw to 27–33 in.lbs. Check and refill reservoir if needed.

CAUTION: Do not turn steering wheel with bleed screw loosened as this could allow air into the system.

BLEEDING AIR FROM SYSTEM

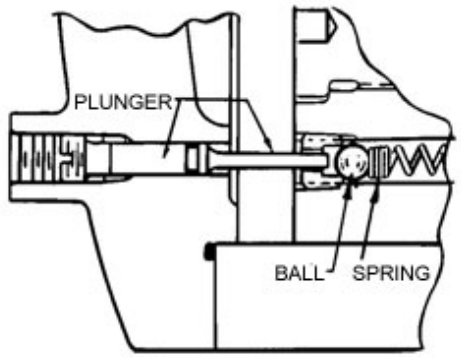
The steering gear by design is self bleeding; however, in some installations where the gear is positioned at an odd angle or where the piston does not make a full stroke in the cylinder bore air can be trapped in the steering gear. To avoid this possibility the air should be bled from the system anytime the oil has been changed or the steering system is repaired.

After reinstalling the steering gear on the vehicle but prior to connecting the drag link to the pitman arm, bleed the air from the steering system in the following manner:

1. Fill pump reservoir with recommended oil. It will be necessary to continue filling after starting the engine and during the bleeding operation until correct oil level is maintained.
2. Set parking brake or block wheels. Start engine and allow it to operate at fast idle speed.
3. With engine running, turn steering wheel from left to right and return making three complete cycles to remove all air from the steering system.
4. Stop engine. Reconnect the drag link.

Following these procedures will ensure that the piston bottoms in both directions of steer, opens the relief valve in the piston, and allows the air to escape to the reservoir and into the atmosphere. (See Fig. A) Check and adjust the relief valve plungers as required.

FIGURE "A"



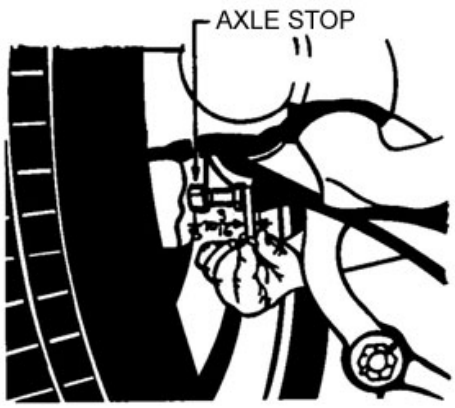
ADJUSTING RELIEF VALVE PLUNGERS

The relief valve plunger adjustment is provided to automatically reduce the steering pressure when the road wheels have reached their limits of turn. This keeps the supply pump from operating at maximum relief pressure when the road wheels are at their steering limits. System temperatures are therefore reduced and high stress loads on the mechanical components of the steering system are relieved.

High–pressure oil at either end of the piston will push the relief ball valve off its seat and fill the relief passage with oil at high pressure. At the opposite end of this passage the relief ball valve is held against its seat and holds the high pressure in the relief passage. As the piston moves close to its limits of stroke, the adjustable relief plungers push the relief ball valve off its seat and the pressure is relieved. The distance the piston can move is dependent upon the total front axle/steering system geometry and tire size. the relief valve plungers are adjustable to allow for variations or changes in these areas. Adjust the relief valve plungers as follows:

1. Start the engine and allow it to operate at idle speed.
2. With full weight of the vehicle on all wheels, turn the steering wheel in one direction until a high–pressure hiss is heard or the axle stops contact.
3. Turn the relief valve plunger in or out until the high–pressure hiss is heard when there is 1/8 to 3/16 inch clearance between the axle stops. (See Fig. B)
4. Repeat this procedure for the opposite direction of steer, and adjust the relief valve plunger on the opposite end of the steering gear.

FIGURE "B"



Turning the plungers in will increase the space between the axle stops. Turning the plungers out will decrease the clearance between the stops. Do not turn the slotted plungers out beyond flush with the plunger boss or a leak will occur. Axle stops should only be adjusted in accordance with the vehicle manufacturer's specifications.

After relief valve plunger adjustment always check to ensure that the road wheels and tires have adequate clearance between suspension, brake and frame components.

Two integral steering gear units are sometimes used where high front axle loads or installation space limitations are encountered.

The secondary gear assembly differs from the master steering gear in that it does not have actuating shaft, nor does the piston have an actuating valve. Both gears are connect to the steering linkage, drag links, pitman arms and rack and pinion gears.

Pressure to operate the secondary, or slave gear, is passed through ports in the cylinder head and bearing cap of the master gear and is routed through high–pressure lines to the proper end of the slave gear. Thus, as the actuating valve of the master gear is moved to cause pressure build up on the piston of the master gear, pressure is also directed to the slave gear piston.

Fluid exhausted from the low pressure end of the master gear is routed through the low pressure pinion gear area of the slave gear and then back to the reservoir.

Early production dual gear systems routed the exhaust fluid from the master gear pinion gear area directly to the reservoir. Later systems route the exhaust fluid from the pinion gear area of the master gear through the pinion gear area of the slave gear and then to the reservoir. The later production method of oil return flow provides faster warm up of the slave gear and offers further assurance that air entrapment in the slave gear is avoided. The pressure relief check valve in the slave gear piston also allows entrapped air to escape to the low pressure side of the piston and be purged from the system. Early slave gear pistons have two check valves. Present versions have only one check valve which might be found on either end of the piston, and is located in the piston end plug.

Pressure relief valve plungers are not required on slave gears as pressure relief is provided by the master gear.

BLEEDING AIR FROM SYSTEM DUAL STEERING

To bleed the air from the steering system on the vehicle after installing the steering gears, the pitman arms may be installed if there is a clearance problem with the pitman arm striking any object using the full travel of the gear. Install them by aligning the timing mark on output shaft with the timing mark on the pitman arm. For torquing see pitman arm torquing assembly. Then proceed in the following manner.

1. Fill pump reservoir with recommended engine oil. (Continue filling after starting engine and during the bleeding operation until correct oil level is maintained.)
2. Set parking brake. Start engine and allow it to operate at fast idle speed.
3. With engine running and drag links disconnected, turn steering wheel to the left and hold until the secondary (slave) gear pitman arm moves the full travel. Then turn to the right and hold until the secondary (slave) gear pitman arm again moves the full travel, repeat this process three or more times.
4. Connect the drag link to the master gear. Do not connect the secondary (slave) gear drag link at this time. Turn steering wheel to the left and hold until the secondary (slave) gear pitman arm moves the full travel. Then turn to the right and hold until the secondary (slave) gear pitman arm lines up with the drag link. Then install the pitman arm. (DO NOT move the pitman arm by hand or air will be pulled back into the system.)

WHEEL SHAKE CONDITION DUAL STEERING

When two integral steering gear units, of the same size, are applied to a single axle application, the geometry of the vehicle is critical. At no time may the effective length of the slave gear pitman arm be shorter than the master gear. If this situation does occur, the slave will power into the drag link and tie rod mechanism, creating a wheel shake, primarily on a left hand turn. To remedy the problem, contact O.E.M. for correct pitman arm timing and design drag link length necessary to balance the system.

The Sheppard Integral Power Steering Gear is dependent upon adequate supplies of oil pressure and volume of oil flow to enable the steering gear to operate as designed. Oil pressure reacting on a piston creates the force to cause the piston to move and assist steering effort.

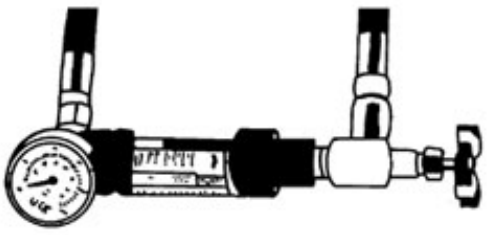
As the piston moves it is displaced in the cylinder bore by a volumn of oil under pressure. How fast the piston can be displaced is dependent upon adequate oil flow and volume.

Oil pressure and oil flow requirements are engineering considerations that are established during the design of a total power steering installation. When diagnosing power steering problems you must be able to determine that oil pressure and oil flow meet design specifications. Pressure and flow specifications vary considerably and the vehicle manufacturer's recommendations must be followed carefully at all times.

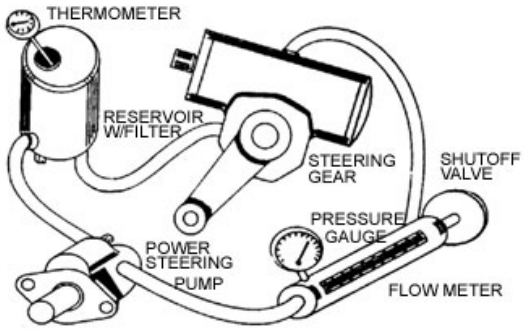
Back pressure and operating temperature are two additional factors that must be considered during the diagnosis of power steering problems. High back pressures will restrict the movement of the piston in the power steering gear and this back pressure must be overcome before steering power is available. Back pressure is caused by restrictions to oil flow. A clogged oil filter, undersized fittings and lines, pinched lines and high flow rates are possible causes of back pressure.

High system oil temperatures reduce the overall efficiency of the steering pump and the steering gear. High temperatures are caused by restriction to flow or inadequate system oil capacity to allow for heat dissipation during normal operation. A supply pump which constantly operates at maximum relief pressure will also generate more heat than can be dissipated.

Various types of pressure gauges and flow meters are available and can be used to diagnose power steering problems. A pressure gauge which reads at least 3000 PSI and a flow meter with a capacity to 10 GPM are used to check pressures and oil flow. A shutoff valve downstream from the pressure gauge makes it possible to isolate the steering pump from the steering gear and by closing the valve, maximum pump relief pressure can be read.



The gauge set illustrated will indicate pressure (PSI) and flow (GPM) with a single connection in series with the high-pressure line to the steering gear. A shut-off valve is included.



A simple thermometer in the reservoir will indicate system oil temperatures.

Using the equipment available to you, proceed with your evaluation of the hydraulic supply system.

1. Make necessary gauge/meter connections.
2. Start engine & check system oil level assuring that oil flow is in proper direction through flow meter.
3. Place thermometer in reservoir.
4. Run the engine at correct idle speed and steer from lock–to–lock several times to allow system to warm up. (140 to 160F)

5. **Pump Maximum Pressure Relief**
   With the engine running at specified idle speed, slowly turn the shutoff valve until closed and read the pressure at which the pressure relief valve opens. (Open the shutoff valve as quickly as possible to avoid heat build–up or possible damage to the steering pump.) This pressure reading should equal the maximum pump pressure specified by the manufacturer of your chassis. Check your specifications.

CAUTION: A malfunctioning pressure relief valve may not relieve pump pressure and closing the shutoff valve may cause severe pump damages or high–pressure hoses to rupture. Constantly observe the pressure gauge while closing the shutoff valve. If pressure rises rapidly or appears to be uncontrolled do not completely close the valve before inspecting the pump and pressure relief valve.

6. **Flow Test Minimum Recommended Flow**
   With the engine running at a specified idle speed, vehicle stationary on the shop floor and with a normal load on the front axle, steer the wheels from full right to full left turn and observe the flow meter. The flow must not fall below the minimum GPM flow specification.

   NOTE: It is important that flow be checked at normal operating temperatures and with a load on the front axle, or steering response complaints may not be found. Inadequate flow will cause binding, uneven or intermittent hard steering.

7. **Flow Test Recommended Maximum**
   Increase the engine speed to approximately 1500 RPM and note the flow rate with the steering wheel stationary. Check this reading against the maximum flow rate specifications. Excessive oil flow can cause high operating temperature, and sluggish heavy steering response.

8. **Leakage Test**
   If the supply pump is performing to specification, install a 1/2 inch spacer between the axle stops on one side, and turn the steering wheel hard in the direction necessary to pinch the spacer block. Record the maximum pressure reading. the maximum pressure reading should be within 100 PSI as was recorded in Step 5 for pump relief pressure when the shutoff valve was closed.

   Remove the spacer and repeat test in the opposite direction. Record pressure.

   If the pressure does not meet the recorded maximum pressure reading, the steering gear is worn internally and must be repaired or replaced.

9. **Back Pressure**
   Normal system back pressure will be 50 to 75 PSI with the engine idling and the steering wheel stationary. Back pressure is checked with the system at normal operating temperature.

10. **Operating Temperatures**
    Steering system oil temperature is best checked after two hours of normal operation. Ideal operating temperature should range betwwen 140F to 160F. Normal operation in this range will allow for intermittently higher temperatures which will be encountered during periods of heavy steering usage.

11. **Aerated Oil**
    Visually check for the presence of air mixed with the oil in the steering system. The oil should be clear. any signs of frothing indicate air entry and steering performance will be affected. Carefully check for leakage on the suction side of the steering pump. Drain and refill the system and bleed for air following the procedure under Final Adjustments section.

Before any steering gear repairs are attempted, the above hydraulic supply evaluation must be completed and corrections made as required. Many times steering gears have been repaired or replaced needlessly because a hydraulic supply system evaluation had not been made.

1. **Wander.** Wander is described as the vehicle not tracking properly on the road surface. The vehicle tends to drift side to side. Continual correction is required to keep the vehicle on the road.

   The driver may describe wander in the following ways:

   * Squirrelly
   * Continually correcting
   * Constantly fighting the wheel
   * Can't hold it on the road
   * All over the road

2. **Pulls.** Pulling is a term used to describe a constant movement of the vehicle in one direction.

   The driver may describe pulling in the following ways:

   * Won't track
   * Pushes to one side
   * Wanders
   * Drives one way
   * Heads for the ditch

   If a directional pull is present, the most probably cause will be misalignment of the rear axle.

3. **Binds.** Binding is an increase in steering wheel effort that is momentary or intermittent.

   The driver may describe binding in the following ways:

   * High spot
   * Hangs up
   * Locks up
   * Catches when turning
   * Siezes

   Binding is normally a result of some mechanical problem with steering components. Most often the bind will occur at the same posistion on the wheel while turning.

4. **No Return** No return is used to describe the lack of wheel coming back to center after a turn or correction is completed.

   The driver may describe no return in the following ways:

   * The wheel won't come back
   * Hangs up in turns
   * Wheel sticks

   No return can result from a misaligned front axle or a bind in mechanical components external to the steering gear. Front axle caster angles should be checked in return complaints.

5. **Hard Steering.** Hard steering is experienced when steering wheel effort exceeds 100 inch pounds measured at the steering wheel retaining nut. Hard steering will remain constant through the full turn. Do not confuse hard steering with binding.

   The driver may describe hard steering in the following ways:

   * No power assist
   * Steers like a manual gear
   * Won't turn all the way

   Hard steering can result from hydraulic and/or mechanical problems. A complete mechanical and hydraulic diagnosis is necessary to determine the cause.

6. **Excessive Free Play / Unresponsive Motion.** Excessive free play is a condition where there is too much steering wheel movement before the steer tires move. A small amount of free play is considered normal.

   The driver may describe free play in the following ways:

   * Too much slop in the wheel
   * Too much backlash
   * Slack in the wheel

   Free play is normally a function of looseness in the linkage.

7. **Shimmy** Shimmy is a shake or vibration of the front tires that is transmitted through the steering wheel.

   The driver may describe shimmy in the following ways:

   * Steering wheel shake
   * Cab shakes
   * Steering wheel chatter

   Shimmy is a funchtion of looseness in the steering linkage, looseness in front end components or unbalanced tires. Shimmy can also be caused by air trapped in the system.

8. **Noise** Noise in the steering system can come from any number of components. Harmonics or hydraulic noise can be caused by fluid flow. Metallic or grinding noises come from component parts.

   The driver may describe noise in the following ways:

   * Growls
   * Swishes
   * Pops when steering
   * Moans

   When noise is present you must first determine if it is a mechanical or hydraulic noise. Most mechanical noises are a result of looseness or wear in components. Hydraulic noise will normally be associated with problems in pump flow, such as cavitation or low fluid levels.

Notes

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