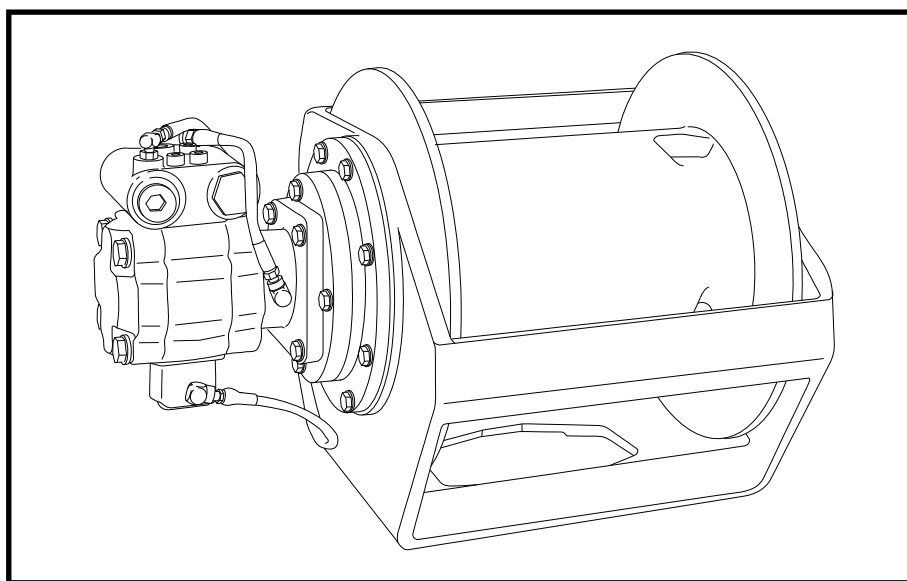


BRADEN

PD12C

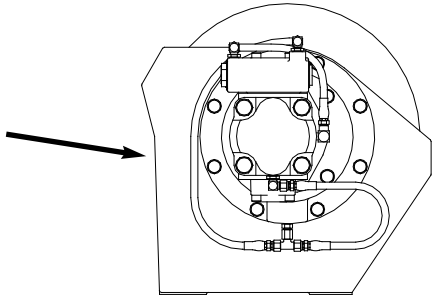
MATERIAL LIST



Visit our website at www.paccarwinch.com for the most comprehensive collection of winch, hoist and drive information on the internet. Most publications and specification sheets are available for downloading.

Refer to Publication LIT 2103 for maintenance and service procedures.

PACCAR WINCH DIVISION
P.O. BOX 547 BROKEN ARROW, OK U.S.A. 74013
PHONE (918) 251-8511 FAX (918) 259-1575
www.paccarwinch.com



Serial Numbers and Model Numbers are located to the left hand side of the hydraulic motor, stamped into the base. Always refer to the Serial Number and Model Number when requesting information or service parts.

EXPLANATION OF MODEL NUMBER

PD **12** **C** **41** **051** - **04X** - **1**
 POWER MAX DESIGN GEAR MOTOR DRUM OPTION
 DRUM RATING MODEL RATIO SIZE SIZE

- PD** DESIGNATES POWER DRUM
- 12** DESIGNATES 15,000 LB. FIRST LAYER LINE PULL
- C** DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
- 41** DESIGNATES TOTAL GEAR REDUCTION, 41 = 41.62:1
- 051** DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV (DECIMAL POINT ELIMINATED).
EXAMPLE: 051 = 5.1 CU IN/REV
- 04X** DESIGNATES THE DRUM (X OPTIONS: "U" DESIGNATES UNDERWIND, "L" DESIGNATES LEFT HAND BASE, "P" DESIGNATES RATCHET & PAWL)
- 1** PERMITS TESTING AND INSPECTION PER API 2C FOR OFFSHORE CRANES

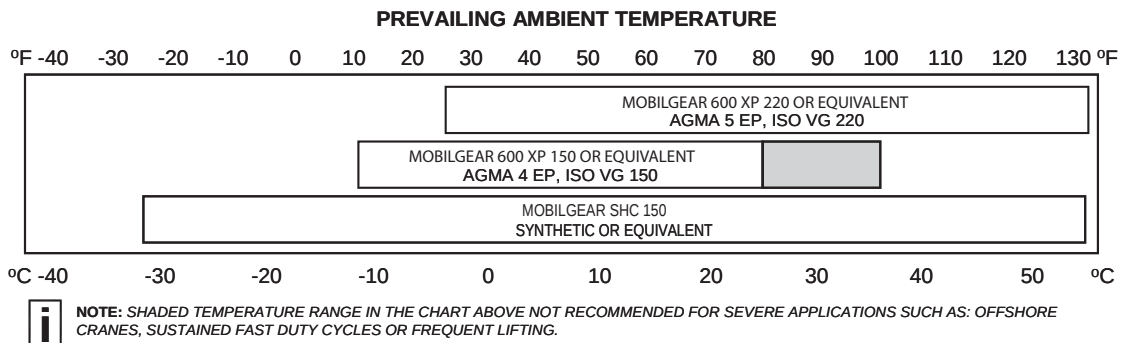
TO ORDER:

- (1) List model and serial numbers of the winch.
- (2) Refer to exploded view and select the component(s) needed and note item number.
- (3) Find item number on material list, show part number, description and quantity required on your order.
- (4) Refer to Parts List and show price for each component or assembly.

RECOMMENDED PLANETARY GEAR OIL

For simplicity, BRADEN has listed available products in each temperature range that have been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

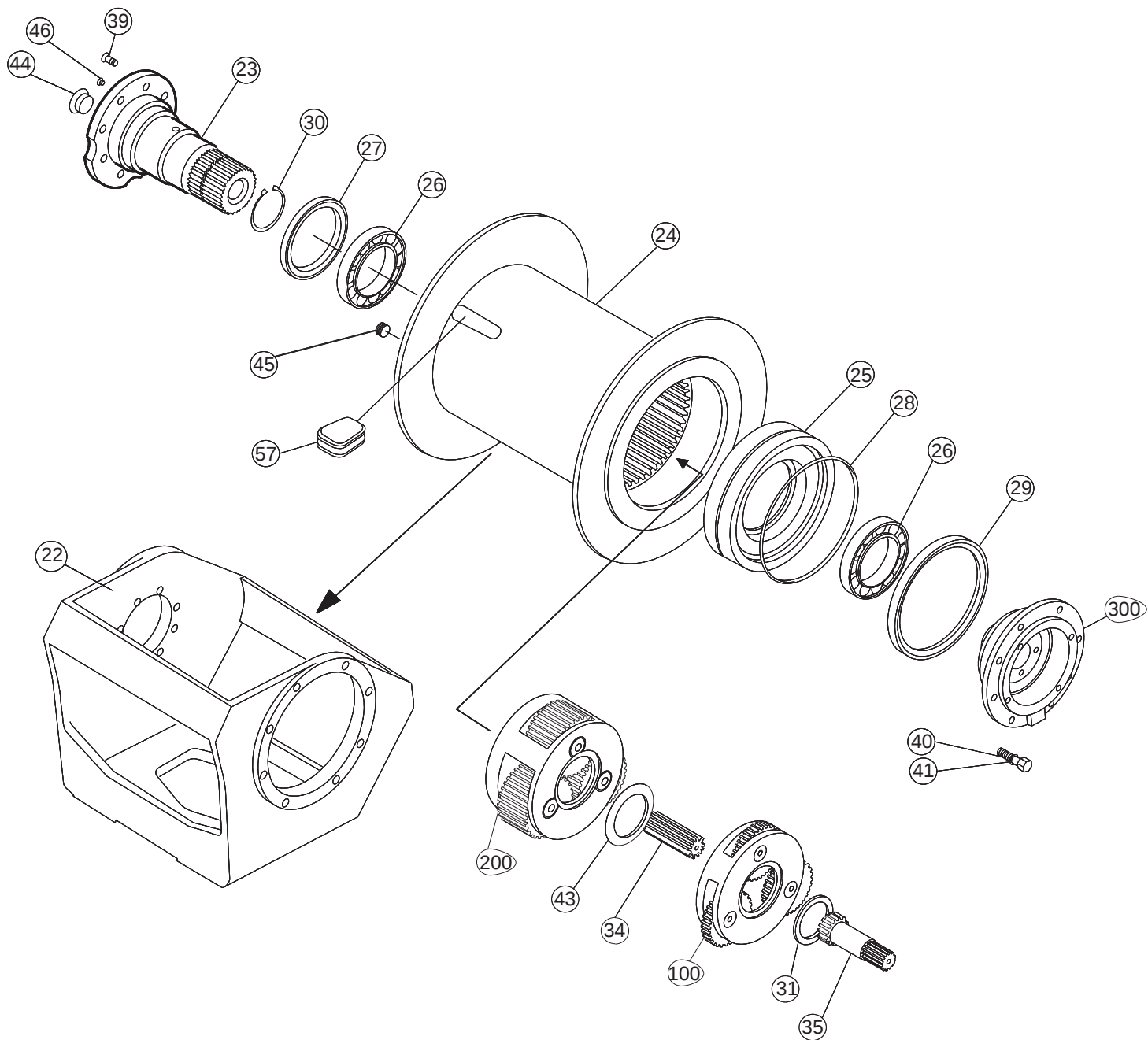
If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.



Planetary hoists are factory filled with Mobilgear 600 XP 150, or equivalent. Consult your oil supplier for other equivalent oils if required.

Mobil	Shell	Chevron	Texaco
Mobilgear 600 XP 150	Omala 150	Gear Compounds EP 150	Meropa 150
Mobilgear 600 XP 220	Omala 220	Gear Compounds EP 220	Meropa 220

BRADEN PD12C COMPONENTS



BRADEN PD12C MAIN ASSEMBLY COMPONENTS

ITEM	DESCRIPTION	PART #	QTY
100	Primary Planet Carrier Assembly	--	1
200	Output Planet Carrier Assembly	--	1
300	Brake Cylinder Assembly	--	1
22	Base (see below)	--	1
24	Cable Drum (01 Drum)	26757	1
	Cable Drum (02 Drum)	25518	1
	Cable Drum (04 Drum) from S/N 9102358	28831	1
	Cable Drum (05 Drum)	25901	1
25	Cable Drum Closure (01 & 04 Drum)	26763	1
	Cable Drum Closure (02 & 05 Drum)	25561	1
26	Ball Bearing	24110	2
27	Oil Seal* (Support End)	24109	1
28	O-Ring*	21033	1
29	Oil Seal* (Drum Closure)	22818	1
31	Primary Thrust Race	40128	1
34	Output Sun	See Next	1
35	Primary Sun	Column	1
40	Capscrew (02 & 05 Hex Head 1/2 x 1 1/2)	104322	8
	Capscrew (01 & 04 Hex Head 1/2 x 1-1/4)	104174	8
41	Lockwasher	11026	8
43	Output Thrust Race	40129	1
45	Drain Plug	32411	1
45a	O-Ring	23950	1
57	Cable Wedge Standard (7/16 - 5/8 in)	40130	1
	Cable Wedge (3/8 in. 10 mm)	24494	1
	Cable Wedge (3/4 in. 19 mm)	24492	1
	Cable Wedge (Poly Rope 1- 1 1/8 in)	24413	1

ITEM	DESCRIPTION	Gear Reduction Ratio				QTY
		21:1	29:1	41:1	59:1	
	Sun Gears	PART #	PART #	PART #	PART #	
34	Output Sun Gear	25608	25608	25610	25610	1
35	Primary Sun Gear	25714	25652	25652	25640	1

O-RING AND SEAL KITS

Part Number 61715 - PD12C Seal Kit

(Contains all seals and O-rings to service any PD12C winch. Not all parts in this kit will be used on any one winch.)

* indicates part in seal kit

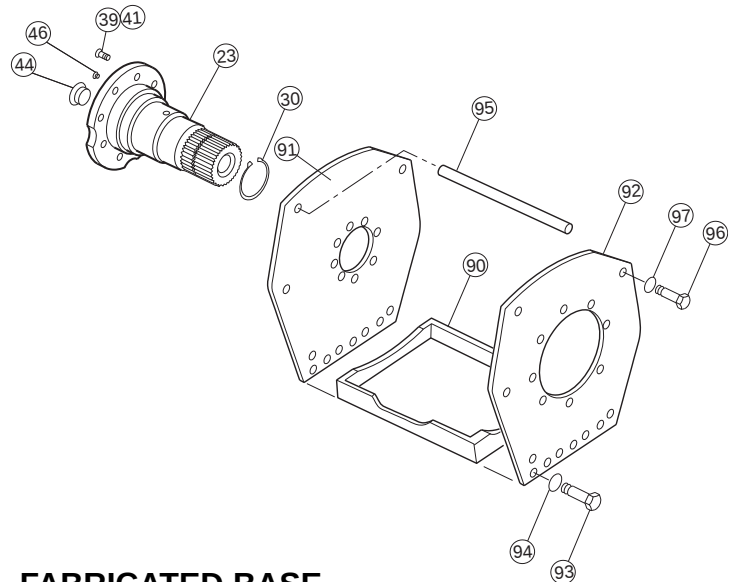
Part Number 61567- Brake Valve O-Ring Kit

(Contains all O-rings and backup rings to service all Braden PD12C gear motor brake valves.)

BASE CONFIGURATIONS

COMMON BASE PARTS

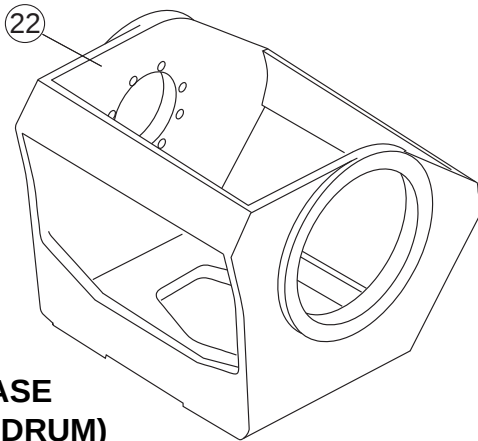
ITEM	DESCRIPTION	PART #	QTY.
30	Retaining Ring	70575	1
44	Plug Hex (Standard Winches)	31386	1
	Plug Flush	24420	1
	Sight Glass (-1 option)	25958	1
44a	O-ring for Item 44 plugs*	24186	1
46	Relief Valve	18062	1



FABRICATED BASE

ITEM	DESCRIPTION	QTY	DRUM OPTION CODE			
			-01	-02 / -05	-02 (LH)	-04
23	BEARING SUPPORT	1	101645	106459	106459	106459
39	CAPSCREW (HEX HD 1/2 X 1 1/4 G8, Z)	8	104174	104174	104174	104174
90	BASE	1	26344	26344	26344	26344
91	SIDE PLATE, BEARING SUPPORT END	1	26764	106466	106466	27212
92	SIDE PLATE, MOTOR END	1	26765	106465	106537	27213
93	CAPSCREW (SPECIAL)	16	103314	103314	103314	103314
94	LOCKWASHER	16	12781	12781	12781	12781
95	TIE BAR	1	26223	26223	26223	--
	TIE BAR	2	--	--	--	26223
96	CAPSCREW (HEX HD 1/2 X 1 1/4 G8, Z)	2	104174	104174	104174	--
	CAPSCREW (HEX HD 1/2 X 1 1/4 G8, Z)	4	--	--	--	104174
97	LOCKWASHER (1/2)	2	11026	11026	11026	--
	LOCKWASHER (1/2)	4	--	--	--	11026

CAST BASE (02 & 05 DRUM)

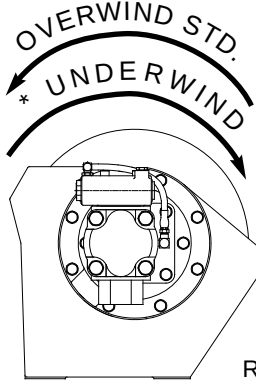


ITEM	DESCRIPTION	PART #	QTY.
22	Base (Right Hand)	25615	1
	Base (Left Hand)	101074	1
23	Bearing Support (01 & 04 Drum)	101645	1
	Bearing Support (02 & 05 Drum)	101644	1
39	Capscrew (1/2 - 13 X 1-1/2 G8 Z)	104322	8
41	Lockwasher (1/2)	11026	8

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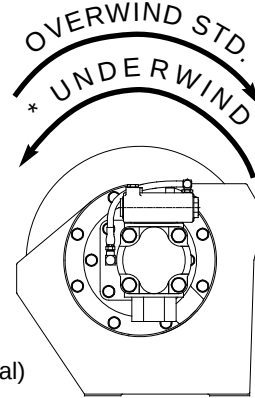
DRUM ROTATION TO HOIST

04 & 05 DRUM/ BASE SHOWN



RH BASE (Standard)

Underwound will have "U" in model number

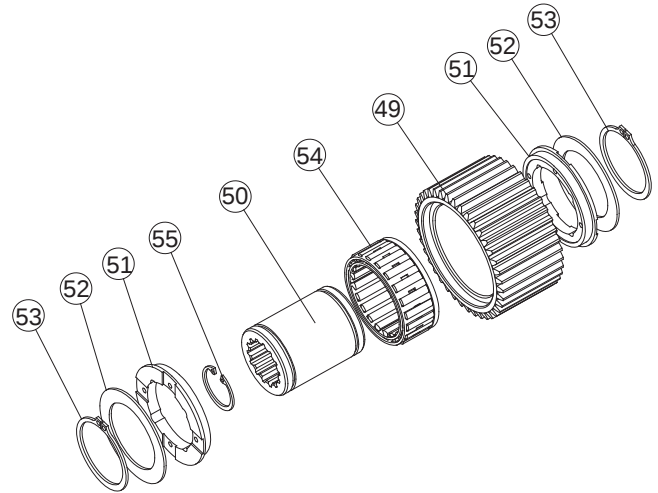


LH BASE (Optional)

BRAKE CLUTCH COMPONENTS

ITEM	DESCRIPTION	SAE B PART #	SAE C PART #	QTY
49	Outer brake race	NSS	NSS	1
50	Inner brake race	NSS	NSS	1
51	Sprag bearing	27684	27684	2
52	Thrust Washer	24581	24581	2
53	Retaining ring	12034	12034	2
54	Sprag clutch	NSS	NSS	1
55	Retaining ring	24031	24506	1

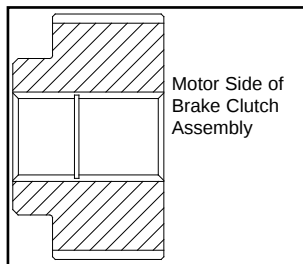
NSS- Not Serviced Separately
Replace entire assembly if wear is present



BRAKE CLUTCH ROTATION

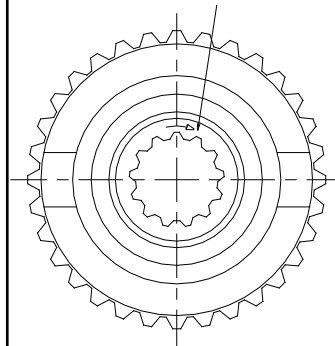
Note: Designation of cable drum rotation is determined by viewing winch from hydraulic motor end while hoisting.

On the BRADEN PD12C the inner race of the brake clutch sprag assembly, when viewed from the motor side, must freewheel in the direction opposite as the cable drum during hoisting.



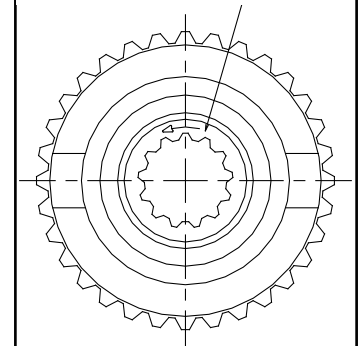
PART #81716 & #81774

Inner Race Freewheels
Clockwise when Viewed
From Motor End



PART #81776 & #81777

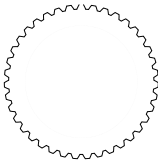
Inner Race Freewheels
CounterClockwise when
Viewed From Motor End



COMPLETE BRAKE CLUTCH ASSEMBLIES

PART #	DESCRIPTION	APPLICATION
81716	SAE C 14T	RH Base Overwind, LH Base Underwind
81776		RH Base Underwind, LH Base Overwind
81774	SAE B 13T	RH Overwind, LH Underwind
81777		RH Underwind, LH Overwind

BRAKE CYLINDER ASSEMBLY



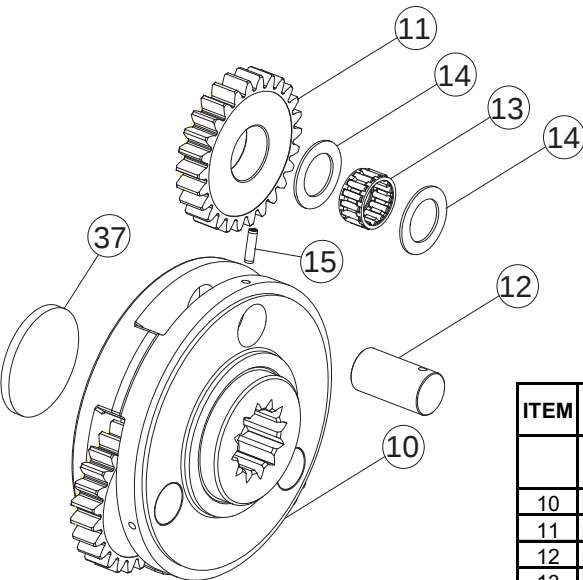
NOTE: MOTOR ADAPTOR MAY BE SPLINED FOR USE IN EARLY MODEL BRAKE ASSEMBLIES. IF ITEM #23 IS SPLINED, USE SPLINED DISCS PN#21029

IF MAJOR REBUILD OF BRAKE ASSEMBLY IS REQUIRED, THE SPLINED MOTOR ADAPTOR IS REPLACED BY THE LOBED MOTOR ADAPTOR AND 8 LOBED DISKS

ITEM	DESCRIPTION	PART #	QTY
1	Brake Cylinder (Lobed Disc) *1	100035	1
23	Motor Adapter (4 Bolt C) 051, 064, 049/024, 064/032	100028	1
	Motor Adapter (2 Bolt B) 029, 034, 039	100458	
	Motor Adapter (2 Bolt A) 080	100097	
2	Brake Piston Seal*	25642	1
3	Pressure Plate	25635	1
4	Piston Backup Ring	25636	1
5	Die Spring	25644	12
6	Friction Disk	21036	7
7	Brake Disk Steel (Lobed)	100027	8
	Brake Disc Steel (Splined)	21029	
36	Spacer	25637	1
41	Lockwasher (for 4 Bolt C & 2 Bolt A)	11026	4
	Lockwasher (for 2 Bolt B)	12781	
42	Capscrew (1/2 NC x 2 G8, Z Hex)	29855	4
47	O-Ring*	24981	1
48	Backup Ring*	25643	1
99	Spring Spacer	100200	1

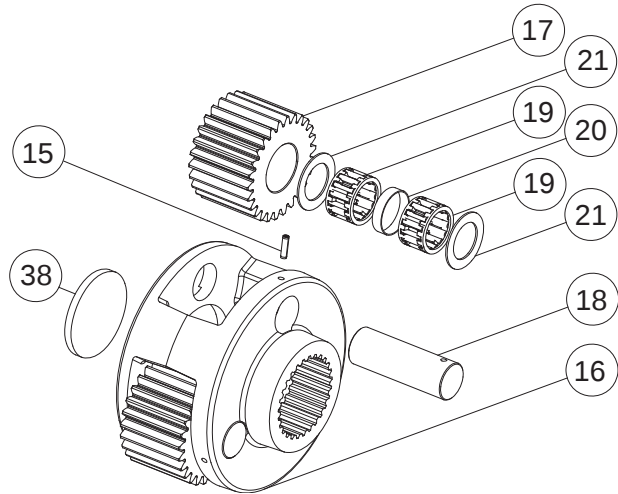
1= Brake Cylinder with cast spring pockets P/N 25564 is replaced by 100035 brake cylinder and 100200 spring spacer

PRIMARY PLANET CARRIER ASSEMBLY



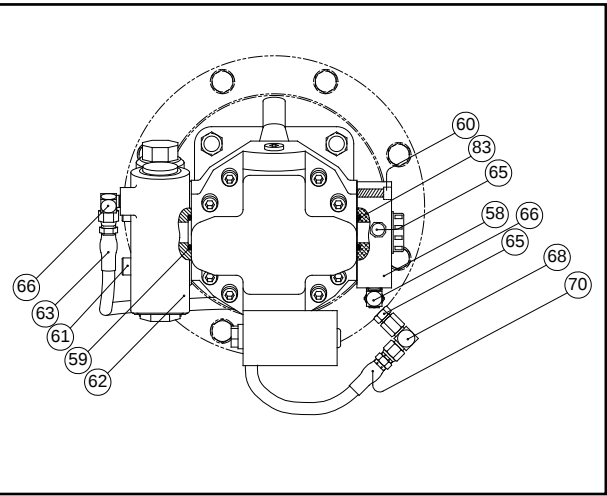
ITEM	DESCRIPTION	Gear Reduction Ratio				QTY
		21:1	29:1	41:1	59:1	
	Primary Carrier Assy	PART #	PART #	PART #	PART #	
		81805	81806	81807	81801	
10	Primary Planet Carrier	25715	25730	25606	25604	1
11	Primary Planet Gear	26280	26278	26278	26276	3
12	Primary Planet Gear Shaft	25614	25614	25614	25614	3
13	Bearing	24175	24175	24175	24175	3
14	Thrust Washer	25361	25361	25361	25361	6
15	Rollpin (Primary Planet Carrier)	24113	24113	24113	24113	3
37	Primary Thrust Plate	25729	25729	25729	25729	1

OUTPUT PLANET CARRIER ASSEMBLY

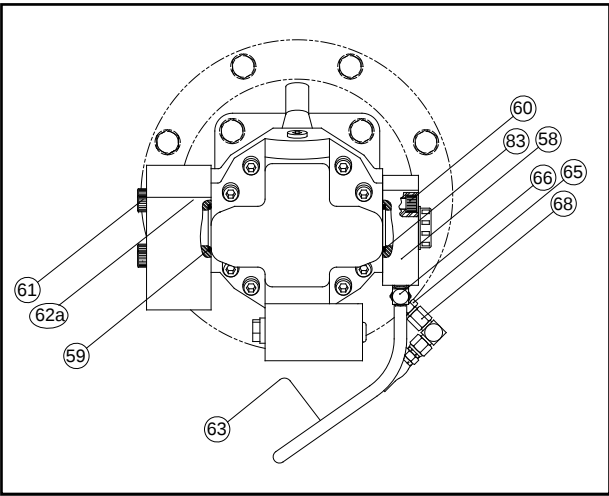


ITEM	DESCRIPTION	Gear Reduction Ratio				QTY
		21:1	29:1	41:1	59:1	
	Output Carrier Assy	PART #	PART #	PART #	PART #	
		81804	81804	81802	81802	
15	Rollpin (Output Planet Carrier)	23584	23584	23584	23584	3
16	Output Planet Carrier	25602	25602	25562	25562	1
17	Output Planet Gear	26279	26279	26277	26277	3
18	Output Planet Gear Shaft	25613	25613	25613	25613	3
19	Bearing	25292	25292	25292	25292	6
20	Bearing Spacer	25443	25443	25443	25443	3
21	Thrust Washer	24306	24306	24306	24306	6
38	Output Thrust Plate	25638	25638	25638	25638	1

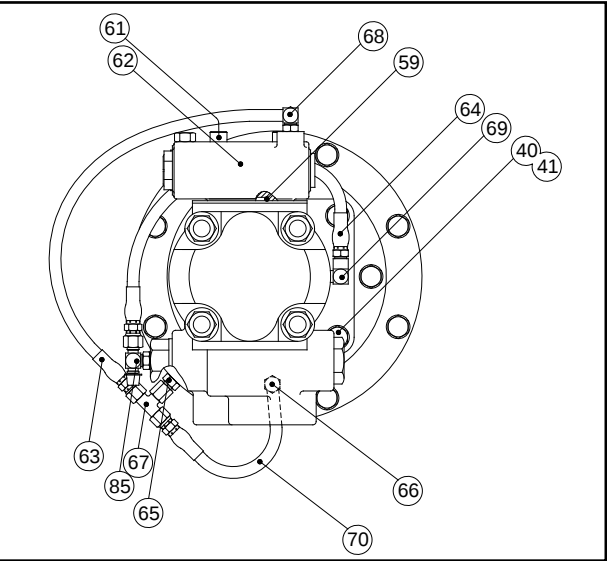
STANDARD MOTOR GROUPS



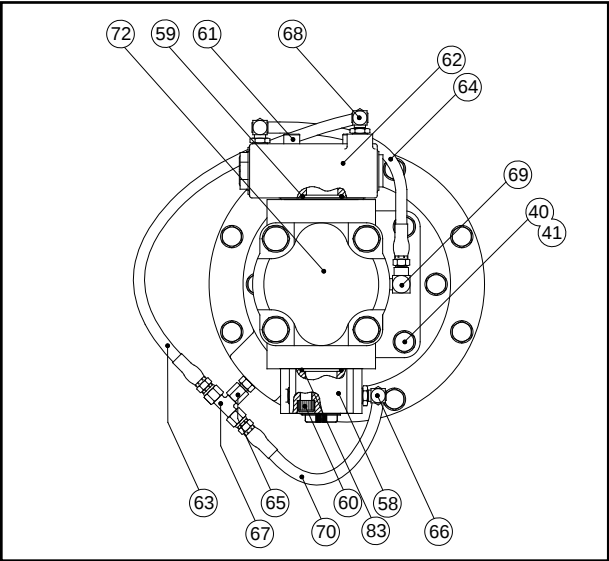
V 33/20
TWO-SPEED, BRAKE VALVE 81719



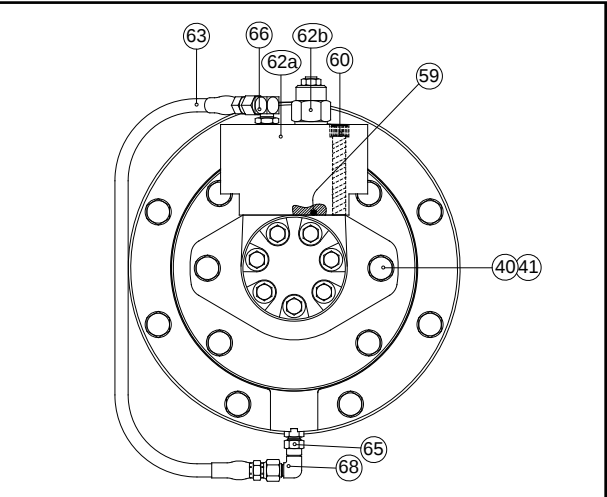
V 33/20
TWO-SPEED, BRAKE VALVE 29576



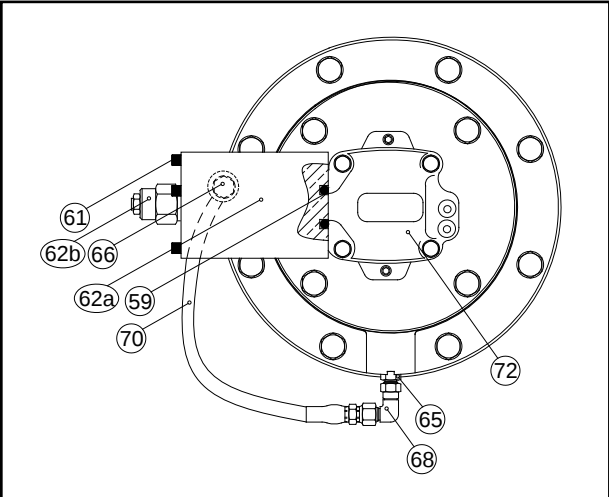
049/024 & 064/032 MOTOR
TWO-SPEED



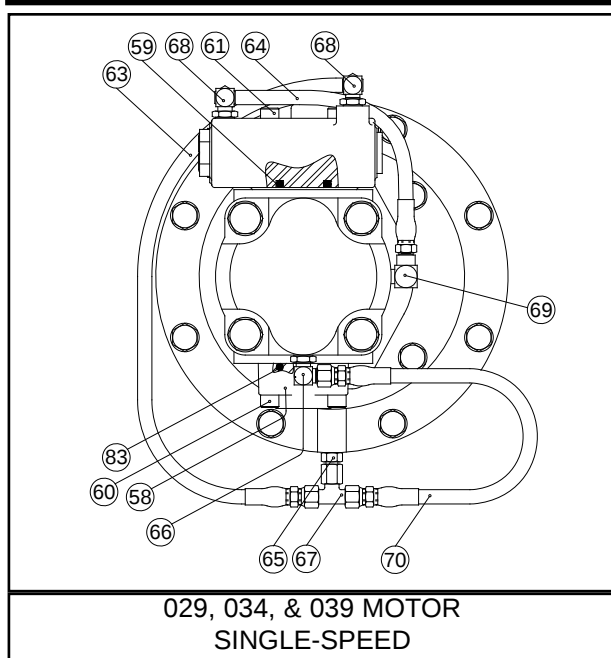
051 & 064 MOTOR
SINGLE-SPEED



071 & 062 MOTOR
SINGLE-SPEED



080 MOTOR
SINGLE-SPEED



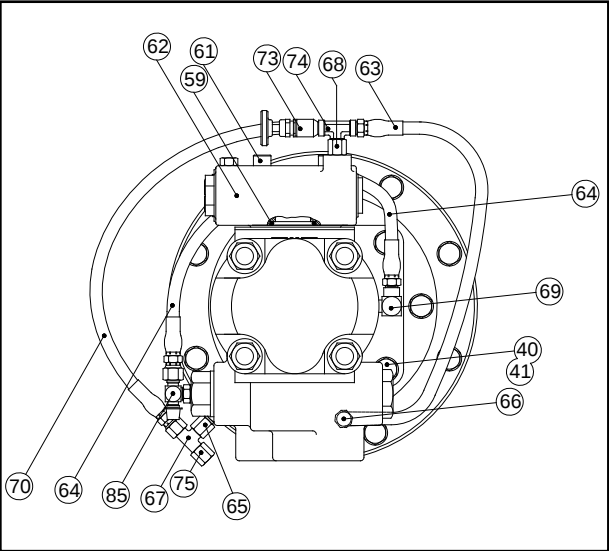
Hydraulic Motors				
ITEM	DESCRIPTION	PART #	QTY	Pilot O-Ring*
5	029 (2 bolt B)	25385	1	21063
	034 (2 bolt B)	24912	1	21063
	039 (2 bolt B)	25515	1	21063
	039 (2 bolt B) Underwound	103887	1	21063
	039 (4 bolt C) CT winches	25896	1	10330
	051 (4 bolt C)	25897	1	10330
	064 (4 bolt C)	25777	1	10330
	049/024 (4 bolt C)	26182	1	10330
	V33/20 (4 bolt C)	100714	1	10330
	064/032 (4 bolt C)	28956	1	10330
	071 Replaced By 062 (2 bolt B)	106079	1	21063
	080 (2 bolt A)	26124	1	22586

MOTOR GROUP (STANDARD WINCHES)

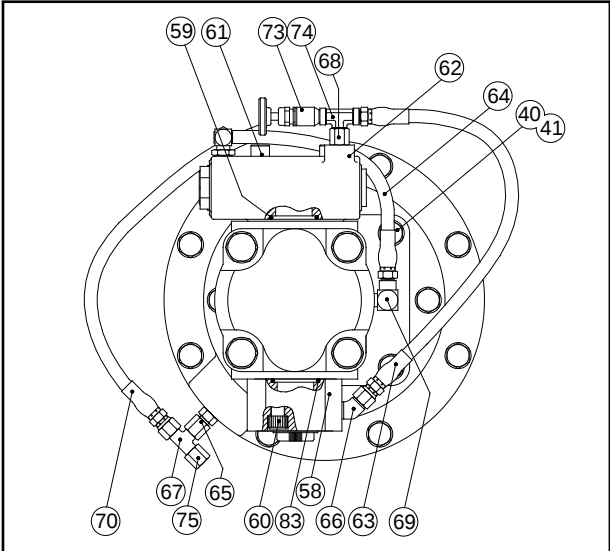
ITEM	QTY	DESCRIPTION	039, 051, 064 4 BOLT-C	049/024 064/032 4 BOLT-C	029, 034, 039 2 BOLT-B	080 2 BOLT-A	071/062 2 BOLT-B	V33/20 4 BOLT-C
40	4	CAPSCREW	104322	104322	104322	21908	104322	104322
41	4	LOCKWASHER	11026	11026	11026	11026	11026	11026
58	1	MANIFOLD	24779	--	25539	--	--	25664
59	1	O-RING	13838	13838	25366	78312	12273	12465
60	4	CAPSCREW	21144	--	--	--	29631	--
	4	CAPSCREW EARLY	--	--	13544	--	--	13544
	4	CAPSCREW CURRENT	--	--	13827	--	--	13827
61	4	CAPSCREW	21134	21134	25622	29630	--	13587
62	1	BRAKE VALVE ASSY	81712	81984	81715	--	--	81719
62A	1	BRAKE VALVE BLOCK	--	--	--	26125	27403	29576
62B	1	BRAKE VALVE CARTRIDGE	--	--	--	26126	27258	29598
63	1	HOSE ASSY	25749	25749	25749	--	25952	25952
64	1	HOSE ASSY	13704	13707	13704	--	--	--
65	1	ADAPTER	25864	25864	25864	25864	25864	25864
66	1	FITTING	21163	25864	25131	31284	25302	25302
67	1	SWIVEL TEE	25748	25748	25748	--	--	--
68	1	CONNECTOR	25302	25302	25302	26140	26140	26140
69	1	REDUCER ELBOW	24236	24236	24236	--	--	--
70	1	HOSE ASSY	25750	25750	25750	25750	--	25952
72	1	HYD. MOTOR	--	--	--	--	--	--
73	1	NEEDLE VALVE	--	--	--	--	--	--
74	1	TEE-MALE BRANCH	--	--	--	--	--	--
75	1	16445-4 CAP NUT	--	--	--	--	--	--
76	1	WARNING TAG	--	--	--	--	--	--
83	1	O-RING	21150	--	25366	--	--	12465
85	1	TEE, -4 ORB	--	29078	--	--	--	--

NOTE: These drawings are standard configurations. Verify hoses, fittings, and capscrews using tables found on pages 10 and 11.

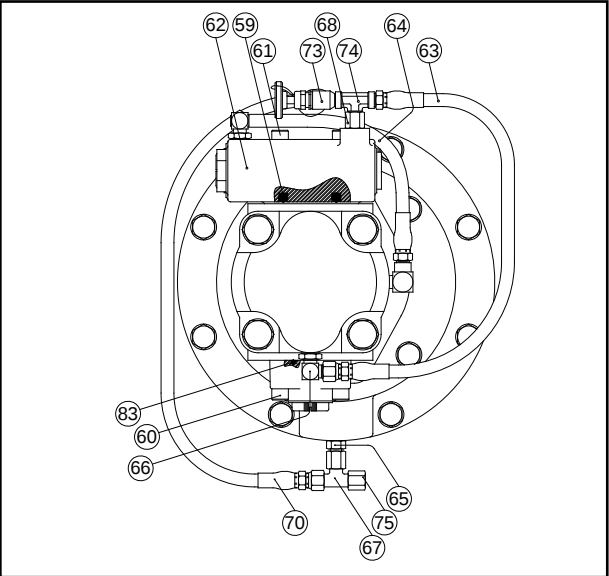
MOTOR GROUPS (-1 OPTION)



049/024 & 064/032 MOTOR
TWO-SPEED PERSONNEL HANDLING



051 & 064 MOTOR
SINGLE-SPEED PERSONNEL HANDLING



029, 034, & 039 MOTOR
SINGLE-SPEED PERSONNEL RATED

MOTOR GROUPS (PERSONNEL RATED WINCHES)					
ITEM	QTY	DESCRIPTION	051 & 64	064/032 049/024	029/034/039
40	4	CAPSCREW	104322	104322	104322
41	4	LOCKWASHER	11026	11026	11026
58	1	MANIFOLD	24779	--	25539
59	1	O-RING	13838	13838	25366
60	4	CAPSCREW	21144	--	--
		CAPSCREW EARLY	--	--	13544
		CAPSCREW CURRENT	--	--	13827
61	4	CAPSCREW	21134	21134	25622
62	1	BRAKE VALVE ASSY	81712	81984	81715
62A	1	BRAKE VALVE BLOCK	--	--	--
62B	1	BRAKE VALVE CARTRIDGE	--	--	--
63	1	HOSE ASSY	13707	13707	13707
64	1	HOSE ASSY	13704	13704	13704
65	1	ADAPTER	25864	25864	25864
66	1	FITTING	21165	25302	25131
67	1	SWIVEL TEE	25748	25748	25748
68	1	CONNECTOR	24784	24784	24784
69	1	REDUCER ELBOW	24236	24236	24236
70	1	HOSE ASSY	13731	13731	13731
72	1	HYD MOTOR	--	--	--
73	1	NEEDLE VALVE	25258	25258	25258
74	1	TEE-MALE BRANCH	22934	22934	22934
75	1	16445-4 CAP NUT	70182	70182	70182
76	1	WARNING TAG	25257	25257	25257
83	1	O-RING	21150	--	25366
85	1	TEE, -4 ORB	--	29078	--

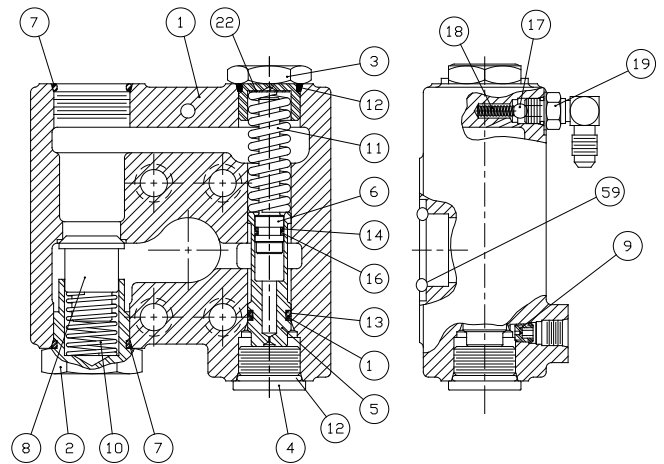
NOTE: These drawings are standard configurations. Verify hoses, fittings, and capscrows using tables found on pages 10 and 11.

BRAKE VALVE PARTS

ITEM	DESCRIPTION	PART #	QTY
1	BRAKE VALVE HOUSING	NSS	1
2	VALVE SPRING RETAINER	24424	1
	RELIEF RETAINER (81719 VALVE)	29609	1
3	SPRING RETAINER	24183	1
4	PLUG	22450	1
5	SPOOL	NSS	1
6	DAMPER PISTON	NSS	1
7	O-RING *	24186	2
8	CHECK VALVE POPPET	24423	1
	RELIEF ASSEMBLY (81719 VALVE)	82132	1
9	PILOT ORIFICE	24200	1
10	CHECK VALVE SPRING	24190	1
11	SPOOL SPRING	24192	1
12	O-RING*	23601	2
13	O-RING*	24193	1
14	O-RING*	24194	1
15	BACK-UP RING*	24195	1
16	BACK-UP RING*	24196	1
22	SHIM, VALVE SPRING	25661	-
17	BALL, STEEL * (81712 & 81715)	21158	1
18	COMPRESSION SPRING	25480	1
19	ELBOW FITTING	25302	1
19	Plug -4 ORB (81984 & 81719)	25663	1
59	O-Ring	13838	1

NSS = Not Serviced Separately

* = Included in Brake O-Ring Kit #61567



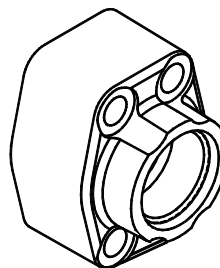
Brake Valves

PART #	FLANGE
81712	1 1/4" CODE 61
81715	1" CODE 61
81719	3/4 " CODE 62
81984	1 1/4" CODE 61

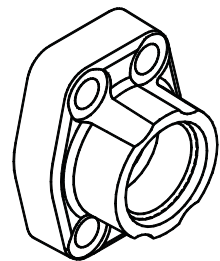
CAPSCREWS AND LOCKWASHERS

PART #	DESCRIPTION
29631	5/16 NC x 3 G8, Socket Head
21654	3/8 NC x 3 1/2 G8, Socket Head
25622	3/8 NC x 2 3/4 G8, Socket Head
29630	3/8 NC x 4 G8, Socket Head
13587	3/8 NC x 3 G8, Socket Head
13544	3/8 NC x 1 1/2 G8, Socket Head EARLY
13827	3/8 NC x 1 1/4 G8, Socket Head CURRENT
21135	7/16 NC x 1 1/2 G8 Z Socket Head
104318	7/16 NC x 1 3/4 G8 Z Hex Head
21144	7/16 NC x 2 G8 Z Socket Head
21134	7/16 NC x 3 G8 Z Socket Head
101150	7/16 NC x 3 3/4 G8 Z Socket Head
104174	1/2 NC x 1 1/4 G8 Z Hex Head
104322	1/2 NC x 1 1/2 G8 Z Hex Head
21908	1/2 NC x 1 1/2 G8 Z Socket Head
29855	1/2 NC x 2 G8 Z Hex Head
103249	5/8 NC x 1 3/4 G8 Z Hex Head
11026	Lockwasher 1/2 Split, Z
102423	Lockwasher 5/8 Split, Z

SPLIT FLANGE ADAPTER



EARLY - Use socket head capscrews 13544.

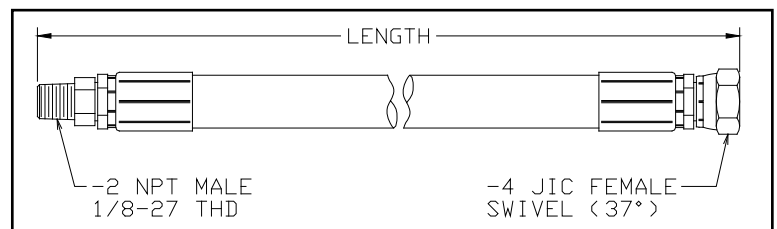


CURRENT - Use socket head capscrews 13827.

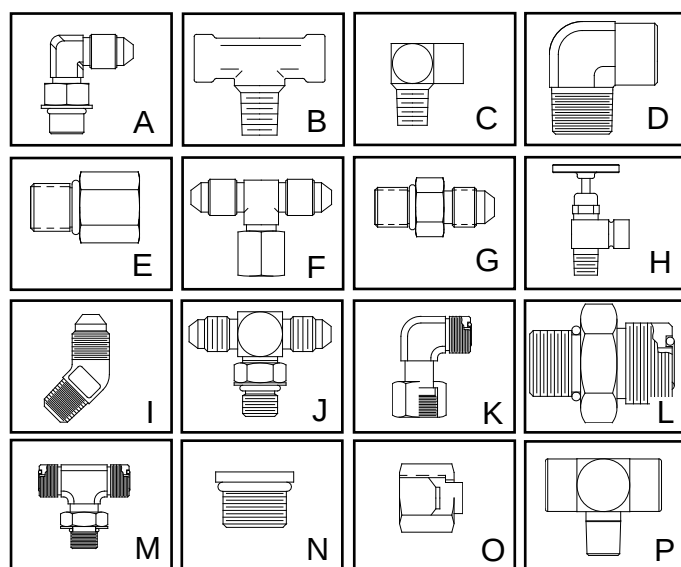
PART NO.	DESCRIPTION
25539	Split Flange Adapter

HOSE ASSEMBLIES

PART #	LENGTH	
13710	8 in.	NPT -2 to JIC -4
13711	10 in.	NPT -2 to JIC -4
13704	12 in.	NPT -2 to JIC -4
13706	16 in.	NPT -2 to JIC -4
13707	17 in.	NPT -2 to JIC -4
13731	22 in.	NPT -2 to JIC -4
24948	30 in.	NPT -2 to JIC -4
25750	17 in.	JIC -4 both ends
25952	20 in.	JIC -4 both ends
25749	22.5 in.	JIC -4 both ends
106269	14 in.	ORFS swivel -8
106270	17 in.	ORFS swivel -8



FITTINGS



PART #	DESCRIPTION	ID
25302	Elbow, -4 JIC to -4 ORB	A
25131	Elbow, -4 JIC to -6 ORB	A
22934	Tee, 1/8-27 NPT-F Run to 1/8-27 NPT-M Branch	B
24236	Street Elbow, Reducer, 1/4-18M to 1/8-27F	C
13708	Street Elbow, 1/8-27	D
24784	Adapter, 7/16 ORB to 1/8-27 NPT-F	E
25748	Swivel Tee, -4 JIC M Run X -4 JIC F Swivel Branch	F
25864	Adapter, -4 JIC to -4 ORB	G
31284	Adapter, -4 JIC to -6 ORB	G
25258	Needle Valve	H
21165	Elbow (45 deg), -2 NPT to -4 JIC	I
21163	Elbow (90 deg), -2 NPT to -4JIC	I
29078	Tee, -4 ORB to -4 JIC	J
100945	ELBOW, ORFS Swivel	K
100946	Adapter, -4 ORB to -6 ORFS	L
102632	Tee, -4 ORFS to -6 ORB	M
69325	Plug, -4 ORB	N
70182	Cap, -4 JIC	O
22934	Tee, F'M pipe to Male pipe -2	P
23508	Reducer Pipe -4 to -2	-
26140	Elbow JIC Swivel -4/-4	-

RECOMMENDED FASTENER TORQUE

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
1/4	20	8	6	12	9
	28	(11)	(8)	(16)	(12)
5/16	18	17	13	24	18
	24	(23)	(17)	(33)	(24)
3/8	16	31	23	45	35
	24	(42)	(31)	(61)	(47)
7/16	14	50	35	70	50
	20	(68)	(47)	(95)	(68)
1/2	13	75	55	110	80
	20	(102)	(75)	(149)	(108)
9/16	12	110	80	150	110
	18	(149)	(108)	(203)	(149)
5/8	11	150	115	210	160
	18	(203)	(156)	(285)	(217)

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
3/4	10	265	200	380	280
	16	(359)	(271)	(515)	(380)
7/8	9	420	325	600	450
	14	(569)	(441)	(813)	(610)
1	8	640	485	910	680
	14	(868)	(658)	(1234)	(922)
1 1/8	7	790	590	1290	970
	12	(1071)	(800)	(1749)	(1315)
1 1/4	7	1120	835	1820	1360
	12	(1518)	(1132)	(2468)	(1817)
1 3/8	6	1460	1095	2385	1790
	12	(1979)	(1485)	(3234)	(2427)
1 1/2	6	1940	1460	3160	2370
	12	(2360)	(1979)	(4284)	(3214)

To convert LB-FT to Kg-m, multiply LB-FT value by 0.1383

8-2008

METRIC CONVERSION TABLE

MULTIPLY:	BY:	TO GET:	MULTIPLY:	BY:	TO GET:
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.3937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches ² (sq.in.)	X 645.15	= millimeters ² (mm ²)	millimeters ² (mm ²)	X 0.000155	= inches ² (sq.in.)
feet ² (sq.ft.)	X 0.0929	= meters ² (m ²)	meters ² (m ²)	X 10.764	= feet ² (sq.ft.)
VOLUME					
inches ³ (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches ³ (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches ³ (cu.in.)	X 16.39	= centimeters ³ (cc)	centimeters3 (cc)	X 0.06102	= inches ³ (cu.in.)
feet ³ (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet ³ (cu.ft.)
feet ³ (cu.ft.)	X 0.02832	= meters ³ (m ³)	meters3 (m3)	X 35.315	= feet ³ (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= millileters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
MASS					
ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)
PRESSURE					
inches Hg (60°F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60°F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm ²)	kilograms/sq.cm. (kg/cm2)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H ₂ O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H ₂ O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)
TEMPERATURE					
°Celsius = 0.556 (°F - 32)			°Fahrenheit = (1.8 X °C) + 32		
COMMON METRIC PREFIXES					
mega	(M)	= 1,000,000 or 10 ⁶	deci	(d)	= 0.1 or 10 ⁻¹
kilo	(k)	= 1,000 or 10 ³	centi	(c)	= 0.01 or 10 ⁻²
hecto	(h)	= 100 or 10 ²	milli	(m)	= 0.001 or 10 ⁻³
deka	(da)	= 10 or 10 ¹	micro	(μ)	= 0.000.001 or 10 ⁻⁶