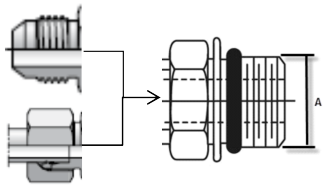
Table 5-14. O-ring Boss (ORB) - Table 3 of 6



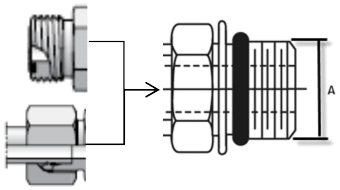
TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(60)	(63)	(66)	7	7	7
	3	3/8-24	0.37	9.52	(100)	(105)	(110)	11	12	12
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	21	22	23	28	30	31
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(39)	(41)	(43)	4	5	5
	3	3/8-24	0.37	9.52	(65)	(69)	(72)	7	8	8
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	15	19	20	20
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

*ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-15. O-ring Boss (ORB) - Table 4 of 6



TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

*ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

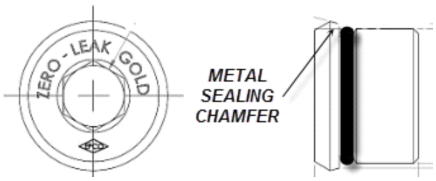
Table 5-16. O-ring Boss (ORB) - Table 5 of 6

TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(30)	(32)	(33)	3	4	4
	3	3/8-24	0.37	9.52	(55)	(58)	(61)	6	7	7
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	16	19	20	22
	6	9/16-18	0.56	14.28	34	36	38	46	49	52
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(20)	(21)	(21)	2	2	2
	3	3/8-24	0.37	9.52	(36)	(38)	(40)	4	4	5
	4	7/16-20	0.44	11.11	6	7	7	8	9	9
	5	1/2-20	0.50	12.70	9	10	10	12	14	14
	6	9/16-18	0.56	14.28	22	24	25	30	33	34
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

*ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-17. O-ring Boss (ORB) - Table 6 of 6



TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						

TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						

*ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Assembly Instructions for Adjustable Port End Metric (MFF) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

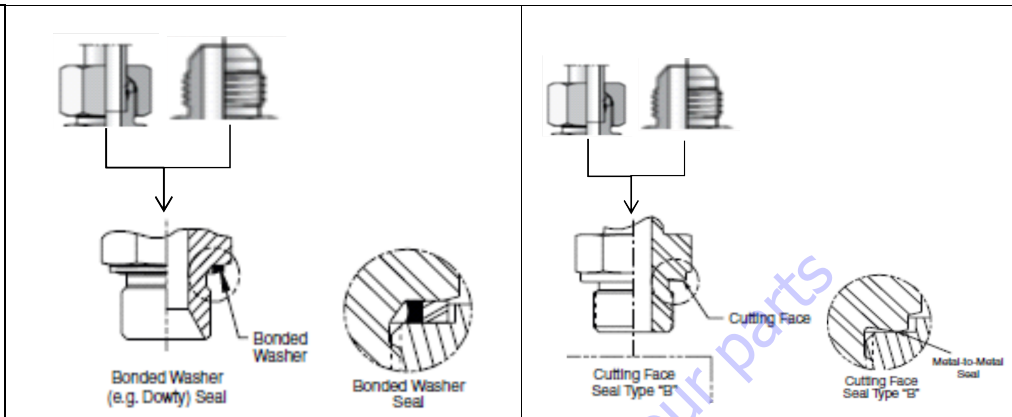
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-18, Table 5-19, Table 5-20, Table 5-21, Table 5-22, or Table 5-23 while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values provided in Table 5-18, Table 5-19, Table 5-20, Table 5-21, Table 5-22, and Table 5-23 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

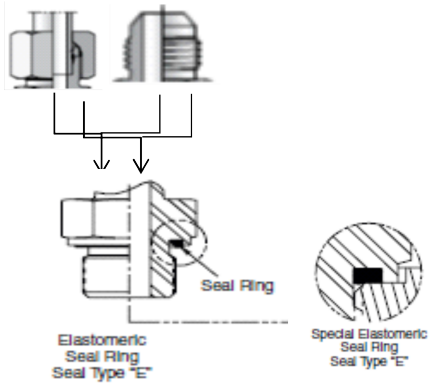
7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

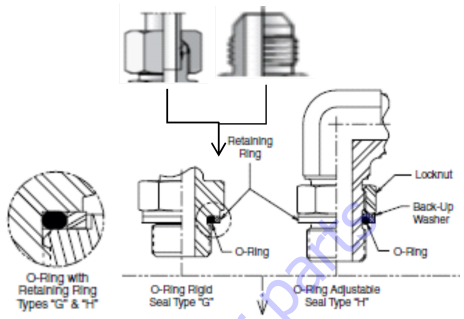
Table 5-18. Metric Flat Face Port (MFF) - L Series - Table 1 of 3



TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	7	8	8	9	11	11	13	14	14	18	19	19
	M12x1.5	8	15	16	17	20	22	23	22	23	24	30	31	33
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	33	35	36	45	47	49	48	51	53	65	69	72
	M18x1.5	15	41	43	45	55	58	61	59	62	65	80	84	88
	M22x1.5	18	48	51	53	65	69	72	103	108	113	140	146	153
	M27x2	22	66	70	73	90	95	99	140	147	154	190	199	209
	M33x2	28	111	117	122	150	159	165	251	264	276	340	358	374
	M42x2	35	177	186	195	240	252	264	369	388	406	500	526	550
	M48x2	42	214	225	235	290	305	319	465	489	512	630	663	694
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	4	5	5	5	7	7	8	9	9	11	12	12
	M12x1.5	8	10	11	11	14	15	15	14	15	16	19	20	22
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	21	22	23	28	30	31	31	33	34	42	45	46
	M18x1.5	15	27	28	29	37	38	39	38	40	42	52	54	57
	M22x1.5	18	31	33	34	42	45	46	67	70	73	91	95	99
	M27x2	22	43	45	47	58	61	64	91	96	100	123	130	136
	M33x2	28	72	76	79	98	103	107	163	171	179	221	232	243
	M42x2	35	115	121	127	156	164	172	240	252	264	325	342	358
	M48x2	42	139	146	153	188	198	207	302	318	332	409	431	450

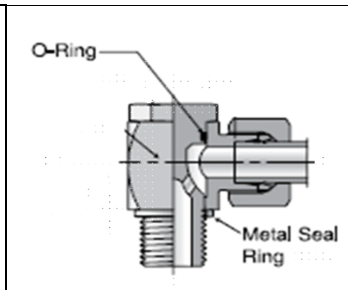
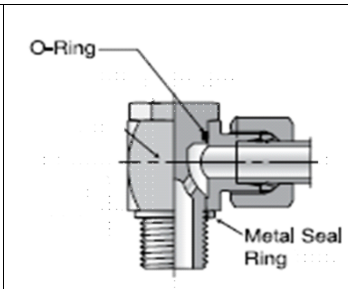
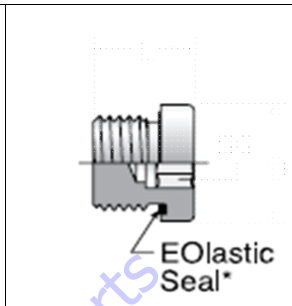
Table 5-19. Metric Flat Face Port (MFF) - L Series - Table 2 of 3





TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS with 37Deg (JIC) or L series DIN (MBTL) opposite end						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	15	18	19	20
	M12x1.5	8	18	19	20	25	26	27	18	19	20	25	26	28
	M14x1.5	10	33	35	36	45	47	49	30	31	32	40	42	44
	M16x1.5	12	41	43	45	55	58	61	41	43	45	55	58	61
	M18x1.5	15	52	55	57	70	75	77	52	54	57	70	74	77
	M22x1.5	18	92	97	101	125	132	137	66	70	73	90	95	99
	M27x2	22	133	140	146	180	190	198	133	139	146	180	189	198
	M33x2	28	229	241	252	310	327	342	229	240	252	310	326	341
	M42x2	35	332	349	365	450	473	495	332	348	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12
	M12x1.5	8	12	13	13	16	18	18	12	13	13	16	18	18
	M14x1.5	10	21	22	23	28	30	31	19	20	21	26	27	29
	M16x1.5	12	27	28	29	37	38	39	26	28	29	36	38	39
	M18x1.5	15	34	36	37	46	49	50	34	35	37	46	48	50
	M22x1.5	18	60	63	66	81	85	89	43	45	47	59	61	64
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

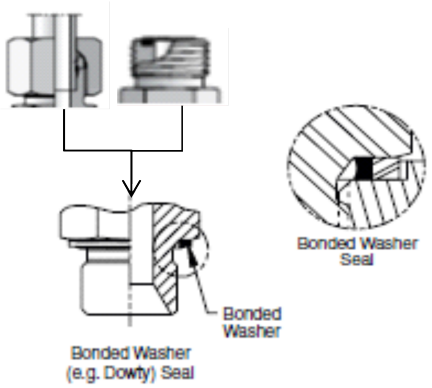
Table 5-20. Metric Flat Face Port (MFF) - L Series - Table 3 of 3

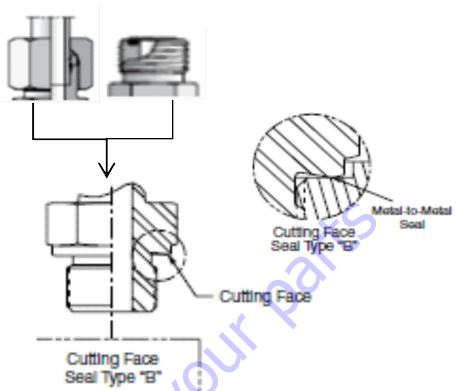
			
TYPE/FITTING IDENTIFICATION	**BANJO FITTINGS with L series DIN (MBTL) opposite end**	**HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end**	**FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS**

MATERIAL	Thread M Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	14	18	19	19	9	10	10	12	14	14
	M12x1.5	8	26	28	29	35	38	39	33	35	36	45	47	49	18	19	20	25	26	27
	M14x1.5	10	37	39	41	50	53	56	41	43	45	55	58	61	26	28	29	35	38	39
	M16x1.5	12	44	46	48	60	62	65	59	62	65	80	84	88	41	43	45	55	58	61
	M18x1.5	15	59	62	65	80	84	88	74	78	81	100	106	110	48	51	53	65	69	72
	M22x1.5	18	89	94	98	120	127	133	103	108	113	140	146	153	66	70	73	90	95	99
	M27x2	22	96	101	106	130	137	144	236	248	260	320	336	353	100	105	110	135	142	149
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	166	175	183	225	237	248
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	266	280	293	360	380	397
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	266	280	293	360	380	397

MATERIAL	Thread M Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	M12x1.5	8	17	18	19	23	24	26	21	22	23	28	30	31	12	13	13	16	18	18
	M14x1.5	10	24	26	27	33	35	37	27	28	29	37	38	39	17	18	19	23	24	26
	M16x1.5	12	29	30	31	39	41	42	38	40	42	52	54	57	27	28	29	37	38	39
	M18x1.5	15	38	40	42	52	54	57	48	51	53	65	69	72	31	33	34	42	45	46
	M22x1.5	18	58	61	64	79	83	87	67	70	73	91	95	99	43	45	47	58	61	64
	M27x2	22	62	66	69	84	89	94	153	161	169	207	218	229	65	69	72	88	94	98
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	108	114	119	146	155	161
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	173	182	190	235	247	258
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	173	182	190	235	247	258

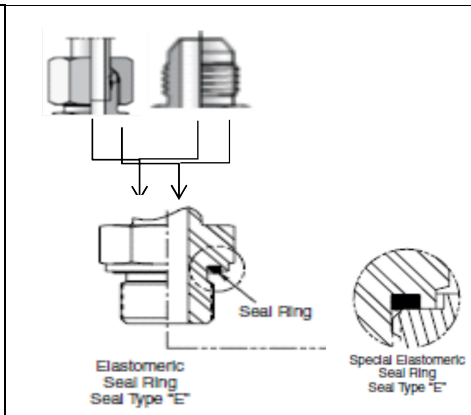
Table 5-21. Metric Flat Face Port (MFF) - S Series - Table 1 of 3

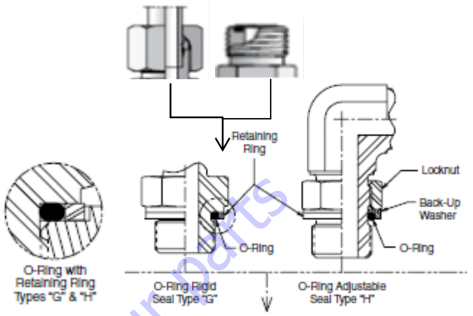




TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	15	16	17	20	22	23	26	28	29	35	38	39
	M14x1.5	8	26	28	29	35	38	39	41	43	45	55	58	61
	M16x1.5	10	33	35	36	45	47	49	52	55	57	70	75	77
	M18x1.5	12	41	43	45	55	58	61	81	85	89	110	115	121
	M20x1.5	14	41	43	45	55	58	61	111	117	122	150	159	165
	M22x1.5	16	48	51	53	65	69	72	125	132	138	170	179	187
	M27x2	20	66	70	73	89	95	99	199	209	219	270	283	297
	M33x2	25	111	117	122	150	159	165	302	317	332	410	430	450
	M42x2	30	177	186	195	240	252	264	398	418	438	540	567	594
	M48x2	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	10	11	11	14	15	15	17	18	19	23	24	26
	M14x1.5	8	17	18	19	23	24	26	27	28	29	37	38	39
	M16x1.5	10	21	22	23	28	30	31	34	36	37	46	49	50
	M18x1.5	12	27	28	29	37	38	39	53	56	58	72	76	79
	M20x1.5	14	27	28	29	37	38	39	72	76	79	98	103	107
	M22x1.5	16	31	33	34	42	45	46	81	86	90	110	117	122
	M27x2	20	43	45	47	58	61	64	129	136	142	175	184	193
	M33x2	25	72	76	79	98	103	107	196	206	216	266	279	293
	M42x2	30	115	121	127	156	164	172	259	272	285	351	369	386
	M48x2	38	139	146	153	188	198	207	335	352	369	454	477	500

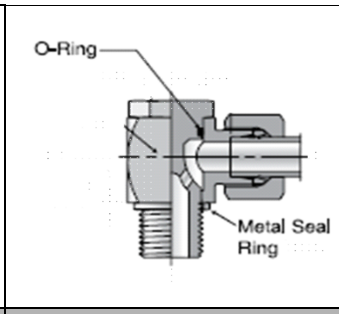
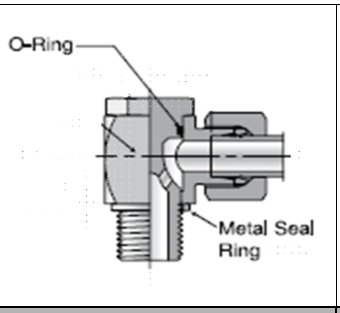
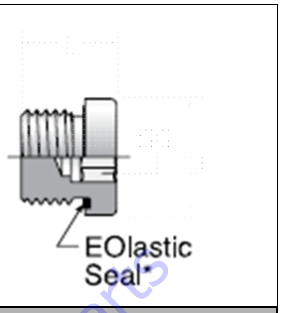
Table 5-22. Metric Flat Face Port (MFF) - S Series - Table 2 of 3





TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	26	28	29	35	38	39
	M12x1.5	8	33	35	36	45	47	49	41	43	45	55	58	61
	M14x1.5	10	52	55	57	70	75	77	52	55	57	70	75	77
	M16x1.5	12	66	70	73	90	95	99	66	70	73	90	95	99
	M18x1.5	15	92	97	101	125	132	137	92	97	101	125	132	137
	M22x1.5	18	100	105	110	135	142	149	100	105	110	135	142	149
	M27x2	22	133	140	146	180	190	198	133	140	146	180	190	198
	M33x2	28	229	241	252	310	327	342	229	241	252	310	327	342
	M42x2	35	332	349	365	450	473	495	332	349	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	17	18	19	23	24	26
	M12x1.5	8	21	23	23	29	31	32	27	28	29	37	38	39
	M14x1.5	10	34	36	37	46	49	50	34	36	37	46	49	50
	M16x1.5	12	43	45	47	58	61	64	43	45	47	58	61	64
	M18x1.5	15	60	63	66	81	85	89	60	63	66	81	85	89
	M22x1.5	18	65	69	72	88	94	98	65	69	72	88	94	98
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

Table 5-23. Metric Flat Face Port (MFF) - S Series - Table 3 of 3

TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with S series DIN (MBTS) opposite end						HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	33	35	36	45	47	49	--	--	--	--	--	--
	M12x1.5	8	37	39	41	50	53	56	41	43	45	55	58	61	--	--	--	--	--	--
	M14x1.5	10	44	46	48	60	62	65	59	62	65	80	84	88	--	--	--	--	--	--
	M16x1.5	12	59	62	65	80	84	88	74	78	81	100	106	110	--	--	--	--	--	--
	M18x1.5	15	81	85	89	110	115	121	92	97	101	125	132	137	59	62	65	80	84	88
	M22x1.5	18	89	94	98	120	127	133	100	105	110	135	142	149	--	--	--	--	--	--
	M27x2	22	100	105	110	135	142	149	236	248	260	320	336	353	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	--	--	--	--	--	--
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	21	22	23	28	30	31	--	--	--	--	--	--
	M12x1.5	8	24	26	27	33	35	37	27	28	29	37	38	39	--	--	--	--	--	--
	M14x1.5	10	29	30	31	39	41	42	38	40	42	52	54	57	--	--	--	--	--	--
	M16x1.5	12	38	40	42	52	54	57	48	51	53	65	69	72	--	--	--	--	--	--
	M18x1.5	15	53	56	58	72	76	79	60	63	66	81	85	89	38	40	42	52	54	57
	M22x1.5	18	58	61	64	79	83	87	65	69	72	88	94	98	--	--	--	--	--	--
	M27x2	22	65	69	72	88	94	98	153	161	169	207	218	229	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	--	--	--	--	--	--

Assembly Instructions for Metric ISO 6149 (MPP) Port Assembly Stud Ends

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not preinstalled, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

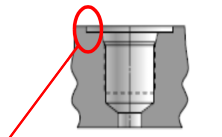
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-24 while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values provided in Table 5-24 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

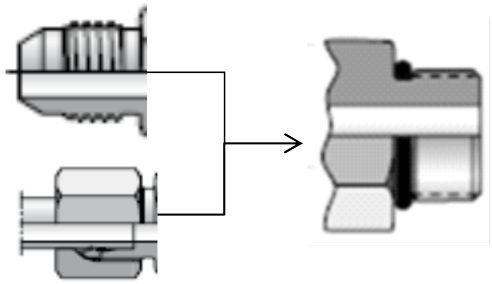
- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

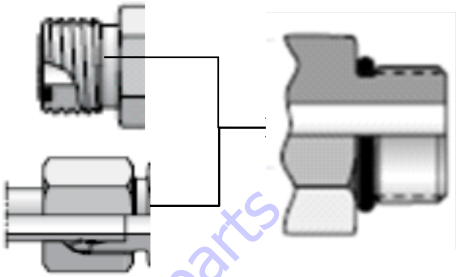
7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-24. Metric Pipe Parallel O-Ring Boss (MPP)



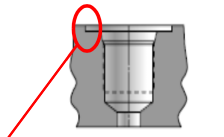
Note: Metric O-ring only style (ISO 6149) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB),**but is not interchangeable.**



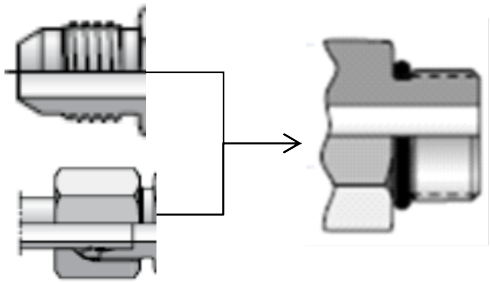


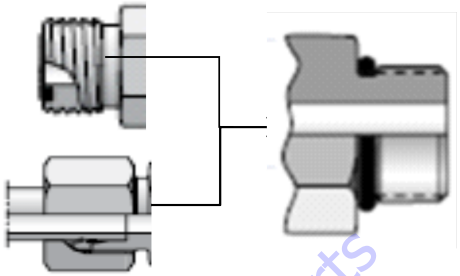
TYPE/FITTING IDENTIFICATION			STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	6	7	7	8	9	9	8	9	9	10	12	12
	M10x1	6	11	12	12	15	16	16	15	16	17	20	22	23
	M12x1.5	8	18	19	20	25	26	27	26	28	29	35	38	39
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	30	32	33	40	43	45	41	43	45	55	58	61
	M18x1.5	15	33	35	36	45	47	49	52	55	57	70	75	77
	M20x1.5	--	--	--	--	--	--	--	59	62	65	80	84	88
	M22x1.5	18	44	46	48	60	62	65	74	78	81	100	106	110
	M27x2	22	74	78	81	100	106	110	125	132	138	170	179	187
	M30x2	--	95	100	105	130	136	142	175	184	193	237	249	262
	M33x2	25	120	126	132	160	171	179	230	242	253	310	328	343
	M38x2	--	135	142	149	183	193	202	235	247	259	319	335	351
	M42x2	30	155	163	171	210	221	232	245	258	270	330	350	366
	M48x2	38	190	200	209	260	271	283	310	326	341	420	442	462
	M60x2	50	230	242	253	315	328	343	370	389	407	500	527	552

Table 5-24. Metric Pipe Parallel O-Ring Boss (MPP)



Note: Metric O-ring only style (ISO 6149) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB),**but is not interchangeable.**





TYPE/FITTING IDENTIFICATION			STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	4	5	5	5	7	7	5	6	6	7	8	8
	M10x1	6	7	8	8	9	11	11	10	11	11	14	15	15
	M12x1.5	8	12	13	13	16	18	18	17	18	19	23	24	26
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	20	21	21	27	28	28	27	28	29	37	38	39
	M18x1.5	15	21	22	23	28	30	31	34	36	37	46	49	50
	M20x1.5	--	--	--	--	--	--	--	30	40	42	41	54	57
	M22x1.5	18	29	30	31	39	41	42	48	51	53	65	69	72
	M27x2	22	48	51	53	65	69	72	81	86	90	110	117	122
	M30x2	--	62	65	68	84	88	92	114	120	125	155	163	169
	M33x2	25	78	82	86	106	111	117	150	157	164	203	213	222
	M38x2	--	88	93	97	119	126	132	153	161	168	207	218	228
	M42x2	30	101	106	111	137	144	150	159	168	176	216	228	239
	M48x2	38	124	130	136	168	176	184	202	212	222	274	287	301
	M60x2	50	150	157	164	203	213	222	241	253	265	327	343	359

Assembly instructions for Adjustable Port End (BSPP) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not preinstalled, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

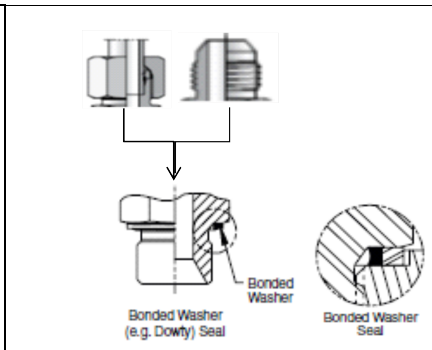
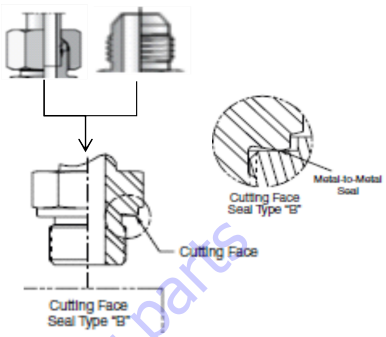
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the O-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-25, Table 5-26, Table 5-27, Table 5-28, Table 5-29, or Table 5-30 while using the Double Wrench Method.
   a. The table headings identify the BSPP port and the type on the other side of the fitting. The torque will be applied to the BSPP port.
   b. Torque values provided in Table 5-25, Table 5-26, Table 5-27, Table 5-28, Table 5-29, and Table 5-30 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the O-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-25. British Standard Parallel Pipe Port (BSPP) - L Series - Table 1 of 3

		
TYPE/FITTING IDENTIFICATION	**FORM A**(SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end**	**FORM B** (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end**

MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	7	8	8	9	11	11	13	14	14	18	19	19
	G1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G3/8A	12	33	35	36	45	47	49	52	55	57	70	75	77
	G1/2A	15	48	51	53	65	69	72	103	108	113	140	146	153
	G1/2A	18	48	51	53	65	69	72	74	78	81	100	106	110
	G3/4A	22	66	70	73	90	95	99	133	140	146	180	190	198
	G1A	28	111	117	122	150	159	165	243	255	267	330	346	362
	G1-1/4A	35	177	186	195	240	252	264	398	418	438	540	567	594
	G1-1/2A	42	214	225	235	290	305	319	465	489	512	630	663	694

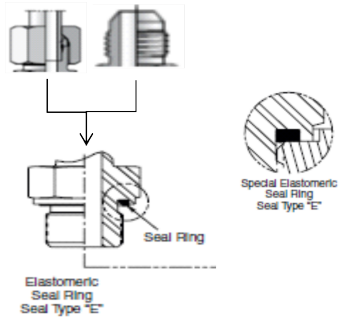
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque [Ft-Lb]			Torque [N-m]			Torque [Ft-Lb]			Torque [N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	4	5	5	5	7	7	8	9	9	11	12	12
	G1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G3/8A	12	21	22	23	28	30	31	34	36	37	46	49	50
	G1/2A	15	31	33	34	42	45	46	67	70	73	91	95	99
	G1/2A	18	31	33	34	42	45	46	48	51	53	65	69	72
	G3/4A	22	42	45	47	57	61	64	86	91	95	117	123	129
	G1A	28	72	76	79	98	103	107	158	166	174	214	225	236
	G1-1/4A	35	115	121	127	156	164	172	259	272	285	351	369	386
	G1-1/2A	42	139	146	153	188	198	207	302	318	333	409	431	451

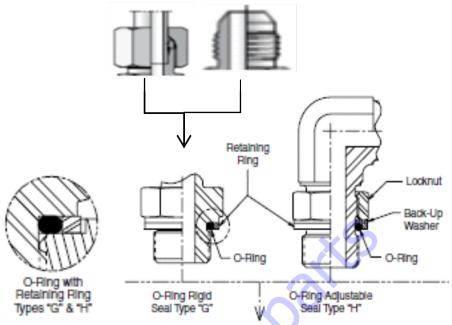
* Typical for JLG Straight Male Stud Fittings

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-26. British Standard Parallel Pipe Port (BSPP) - L Series - Table 2 of 3





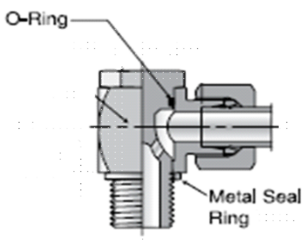
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19
	G1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G3/8A	12	52	55	57	70	75	77	52	55	57	70	75	77
	G1/2A	15	66	70	73	90	95	99	66	70	73	90	95	99
	G1/2A	18	66	70	73	90	95	99	66	70	73	90	95	99
	G3/4A	22	133	140	146	180	190	198	133	140	146	180	190	198
	G1A	28	229	241	252	310	327	342	229	241	252	310	327	342
	G1-1/4A	35	332	349	365	450	473	495	332	349	365	450	473	495
	G1-1/2A	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12
	G1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G3/8A	12	34	36	37	46	49	50	34	36	37	46	49	50
	G1/2A	15	43	45	47	58	61	64	43	45	47	58	61	64
	G1/2A	18	43	45	47	58	61	64	43	45	47	58	61	64
	G3/4A	22	86	91	95	117	123	129	86	91	95	117	123	129
	G1A	28	149	157	164	202	213	222	149	157	164	202	213	222
	G1-1/4A	35	216	227	237	293	308	321	216	227	237	293	308	321
	G1-1/2A	42	259	272	285	351	369	386	259	272	285	351	369	386

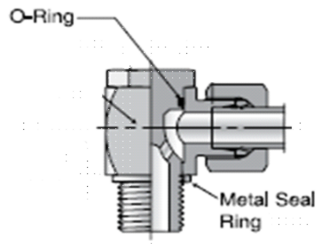
* Typical for JLG Straight Male Stud Fittings

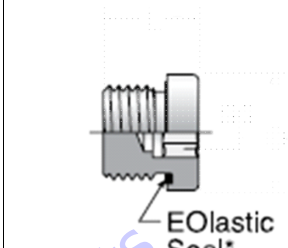
** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-27. British Standard Parallel Pipe Port (BSPP) - L Series - Table 3 of 3







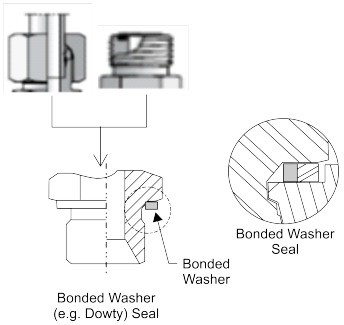
TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with L series DIN (MBTL) opposite end						HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19	10	11	11	13	15	15
	G1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G1/4A	10	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77	44	46	48	60	62	65
	G1/2A	15	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G1/2A	18	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G3/4A	22	92	97	101	125	132	137	170	179	187	230	243	254	103	108	113	140	146	153
	G1A	28	--	--	--	--	--	--	236	248	260	320	336	353	148	156	163	200	212	221
	G1-1/4A	35	--	--	--	--	--	--	398	418	438	540	567	594	295	313.5	332	400	425	450
	G1-1/2A	42	--	--	--	--	--	--	516	542	568	700	735	770	332	349	365	450	473	495
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	G1/4A	8	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G1/4A	10	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50	29	30	31	39	41	42
	G1/2A	15	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G1/2A	18	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G3/4A	22	60	63	66	81	85	89	111	117	122	150	159	165	67	70	73	91	95	99
	G1A	28	--	--	--	--	--	--	153	161	169	207	218	229	96	101	106	130	137	144
	G1-1/4A	35	--	--	--	--	--	--	259	272	285	351	369	386	216	227	237	293	308	321
	G1-1/2A	42	--	--	--	--	--	--	335	352	369	454	477	500	216	227	237	293	308	321

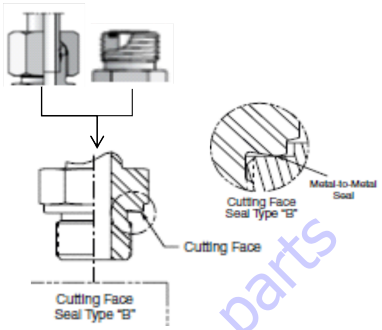
* Typical for JLG Straight Male Stud Fittings

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-28. British Standard Parallel Pipe Port (BSPP) - S Series - Table 1 of 3





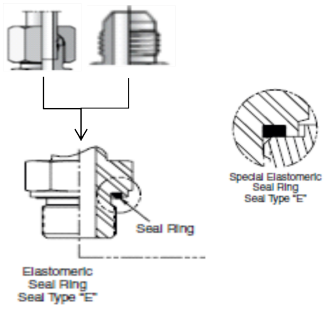
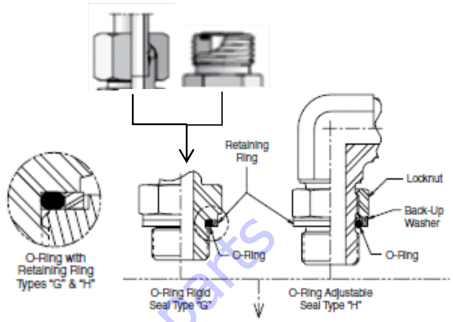
TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B** (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	26	28	29	35	38	39	41	43	45	55	58	61
	G1/4A	8	26	28	29	35	38	39	41	43	45	55	58	61
	G3/8A	10	33	35	36	45	47	49	66	70	73	90	95	99
	G3/8A	12	33	35	36	45	47	49	66	70	73	90	95	99
	G1/2A	14	48	51	53	65	69	72	111	117	122	150	159	165
	G1/2A	16	48	51	53	65	69	72	96	101	106	130	137	144
	G3/4A	20	66	70	73	90	95	99	199	209	219	270	283	297
	G1A	25	111	117	122	150	159	165	251	264	276	340	358	374
	G1-1/4A	30	177	186	195	240	252	264	398	418	438	540	567	594
	G1-1/2A	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	17	18	19	23	24	26	27	28	29	37	38	39
	G1/4A	8	17	18	19	23	24	26	27	28	29	37	38	39
	G3/8A	10	21	22	23	28	30	31	43	45	47	58	61	64
	G3/8A	12	21	22	23	28	30	31	43	45	47	58	61	64
	G1/2A	14	31	33	34	42	45	46	72	76	79	98	103	107
	G1/2A	16	31	33	34	42	45	46	62	66	69	84	89	94
	G3/4A	20	43	45	47	58	61	64	129	136	142	175	184	193
	G1A	25	72	76	79	98	103	107	163	171	179	221	232	243
	G1-1/4A	30	115	121	127	156	164	172	259	272	285	351	369	386
	G1-1/2A	38	139	146	153	188	198	207	335	352	369	454	477	500

* Typical for JLG Straight Male Stud Fittings

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-29. British Standard Parallel Pipe Port (BSPP) - S Series - Table 2 of 3

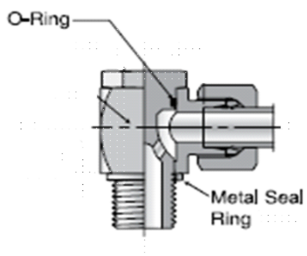
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	41	43	45	55	58	61	26	28	29	35	38	39
	G1/4A	8	41	43	45	55	58	61	26	28	29	35	38	39
	G3/8A	10	59	62	65	80	84	88	52	55	57	70	75	77
	G3/8A	12	59	62	65	80	84	88	52	55	57	70	75	77
	G1/2A	14	85	90	94	115	122	127	66	70	73	90	95	99
	G1/2A	16	85	90	94	115	122	127	66	70	73	90	95	99
	G3/4A	20	133	140	146	180	190	198	133	140	146	180	190	198
	G1A	25	229	241	252	310	327	342	229	241	252	310	327	342
	G1-1/4A	30	332	349	365	450	473	495	332	349	365	450	473	495
	G1-1/2A	38	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	27	28	29	37	38	39	17	18	19	23	24	26
	G1/4A	8	27	28	29	37	38	39	17	18	19	23	24	26
	G3/8A	10	38	40	42	52	54	57	34	36	37	46	49	50
	G3/8A	12	38	40	42	52	54	57	34	36	37	46	49	50
	G1/2A	14	55	58	61	75	79	83	43	45	47	58	61	64
	G1/2A	16	55	58	61	75	79	83	43	45	47	58	61	64
	G3/4A	20	86	91	95	117	123	129	86	91	95	117	123	129
	G1A	25	149	157	164	202	213	222	149	157	164	202	213	222
	G1-1/4A	30	216	227	237	293	308	321	216	227	237	293	308	321
	G1-1/2A	38	259	272	285	351	369	386	259	272	285	351	369	386

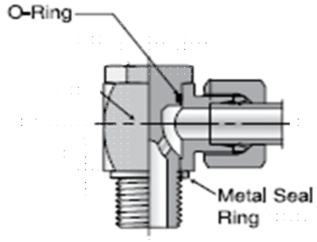
* Typical for JLG Straight Male Stud Fittings

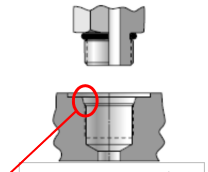
** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-30. British Standard Parallel Pipe Port (BSPP) - S Series - Table 3 of 3







Note: BSPP O-ring only style (ISO 228-1) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB), **but is not interchangeable. Not typically used on JLG machines.**

TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with S series DIN (MBTS) opposite end						HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end						JIS/BSPP O-RING ONLY					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	30	32	33	40	43	45	33	35	36	45	47	49	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49						
	G3/8A	10	48	51	53	65	69	72	52	55	57	70	75	77						
	G3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77						
	G1/2A	14	66	70	73	90	95	99	89	94	98	120	127	133						
	G1/2A	16	66	70	73	90	95	99	89	94	98	120	127	133						
	G3/4A	20	92	97	101	125	132	137	170	179	187	230	243	254						
	G1A	25	--	--	--	--	--	--	236	248	260	320	336	353						
	G1-1/4A	30	--	--	--	--	--	--	398	418	438	540	567	594						
	G1-1/2A	38	--	--	--	--	--	--	516	542	568	700	735	770						
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G1/4A	6	20	21	21	27	28	28	22	22	23	30	30	31	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G1/4A	8	20	21	21	27	28	28	22	22	23	30	30	31						
	G3/8A	10	31	33	34	42	45	46	34	36	37	46	49	50						
	G3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50						
	G1/2A	14	43	45	47	58	61	64	58	61	64	79	83	87						
	G1/2A	16	43	45	47	58	61	64	58	61	64	79	83	87						
	G3/4A	20	60	63	66	81	85	89	111	117	122	150	159	165						
	G1A	25	--	--	--	--	--	--	153	161	169	207	218	229						
	G1-1/4A	30	--	--	--	--	--	--	259	272	285	351	369	386						
	G1-1/2A	38	--	--	--	--	--	--	335	352	368	454	477	499						

*Typical for JLG Straight Male Stud Fittings

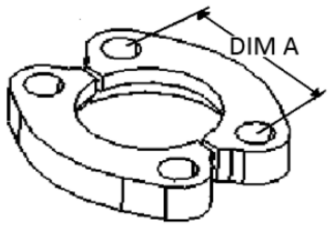
**Non typical for JLG Straight Male Stud Fittings, reference only.

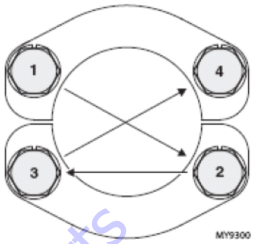
***Typical for JLG Adjustable Fittings

Assembly Instructions for Flange Connections: (FL61 and FL62)

1. Make sure sealing surfaces are free of rust, splits, scratches, dirt, foreign matter, or burrs.
2. See Figure for O-ring installation instructions.
3. Pre-lubricate the O-ring with Hydraulic Oil.
4. Position flange and clamp halves.
5. Place lock washers on bolt and bolt through clamp halves.
6. Tighten all bolts by hand.
7. Torque bolts in diagonal sequence in two or more increments to the torque listed on Table Table 5-31and Table 5-32.

Table 5-31. Flange Code (FL61 & FL62) - Inch Fasteners

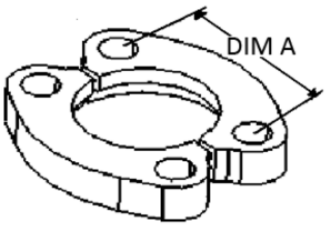


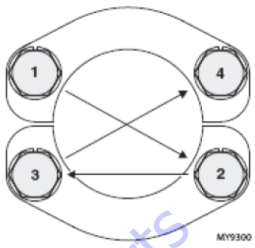


TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws						
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	5/16-18	18	19	19	24	25	26	24	25	26	32	34	35	
	12	0.75	19	1.88	47.75	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66	
	16	1.00	25	2.06	52.32	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66	
	20	1.25	32	2.31	58.67	7/16-14	52	54	57	70	74	77	68	71	75	92	97	101	
	24	1.50	38	2.75	69.85	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165	
	32	2.00	51	3.06	77.72	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165	
	40	2.50	64	3.50	88.90	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165	
	48	3.00	76	4.19	106.43	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325	
	56	3.50	89	4.75	120.65	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325	
	64	4.00	102	5.13	130.30	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325	
	80	5.00	127	6.00	152.40	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325	
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws						
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	5/16-18	--	--	--	--	--	--	24	25	26	32	34	35	
	12	0.75	19	2.00	50.80	3/8-16	--	--	--	--	--	--	44	46	49	60	63	66	
	16	1.00	25	2.25	57.15	7/16-14	--	--	--	--	--	--	68	71	75	92	97	101	
	20	1.25	32	2.62	66.55	1/2-13	--	--	--	--	--	--	111	116	122	150	158	165	
	20	1.25	32	2.62	66.55	--	--	--	--	--	--	--	--	--	--	--	--	--	
	24	1.50	38	3.12	79.25	5/8-11	--	--	--	--	--	--	218	228	239	295	310	325	
	32	2.00	51	3.81	96.77	3/4-10	--	--	--	--	--	--	332	348	365	450	473	495	

* A dimension for reference only.

Table 5-32. Flange Code (FL61 & FL62) - Metric Fasteners





TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
	12	0.75	19	1.88	47.75	M8x1.25	18	19	19	24	25	26	18	19	19	24	25	26
	16	1.00	25	2.06	52.32	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	20	1.25	32	2.31	58.67	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	24	1.50	38	2.75	69.85	M10x1.5	37	39	41	50	53	55	37	39	41	50	53	55
	32	2.00	51	3.06	77.72	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	40	2.50	64	3.50	88.90	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	48	3.00	76	4.19	106.43	M12x1.75	68	71	75	92	97	101	68	71	75	92	97	101
	56	3.50	89	4.75	120.65	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
	64	4.00	102	5.13	130.30	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
	80	5.00	127	6.00	152.40	M16x2	155	163	170	210	221	231	155	163	170	210	221	231
TYPE	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	M8x1.25	--	--	--	--	--	--	24	25	26	32	34	35
	12	0.75	19	2.00	50.80	M10x1.5	--	--	--	--	--	--	52	54	57	70	74	77
	16	1.00	25	2.25	57.15	M12x1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M12x1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M14x2	--	--	--	--	--	--	133	139	146	180	189	198
	24	1.50	38	3.12	79.25	M16x2	--	--	--	--	--	--	218	228	239	295	310	325
	32	2.00	51	3.81	96.77	M20x2.5	--	--	--	--	--	--	406	426	446	550	578	605

* A dimension for reference only.

Double Wrench Method

To prevent undesired hose or connector rotation, two wrenches must be used; one torque wrench and one backup wrench. If two wrenches are not used, inadvertent component rotation may occur which absorbs torque and causes improper joint load and leads to leaks. For hose connections, the 'layline' printed on the hose is a good indicator of proper hose installation. A twisted lay-line usually indicates the hose is twisted. See Figure 5-12. for double wrench method requirements.

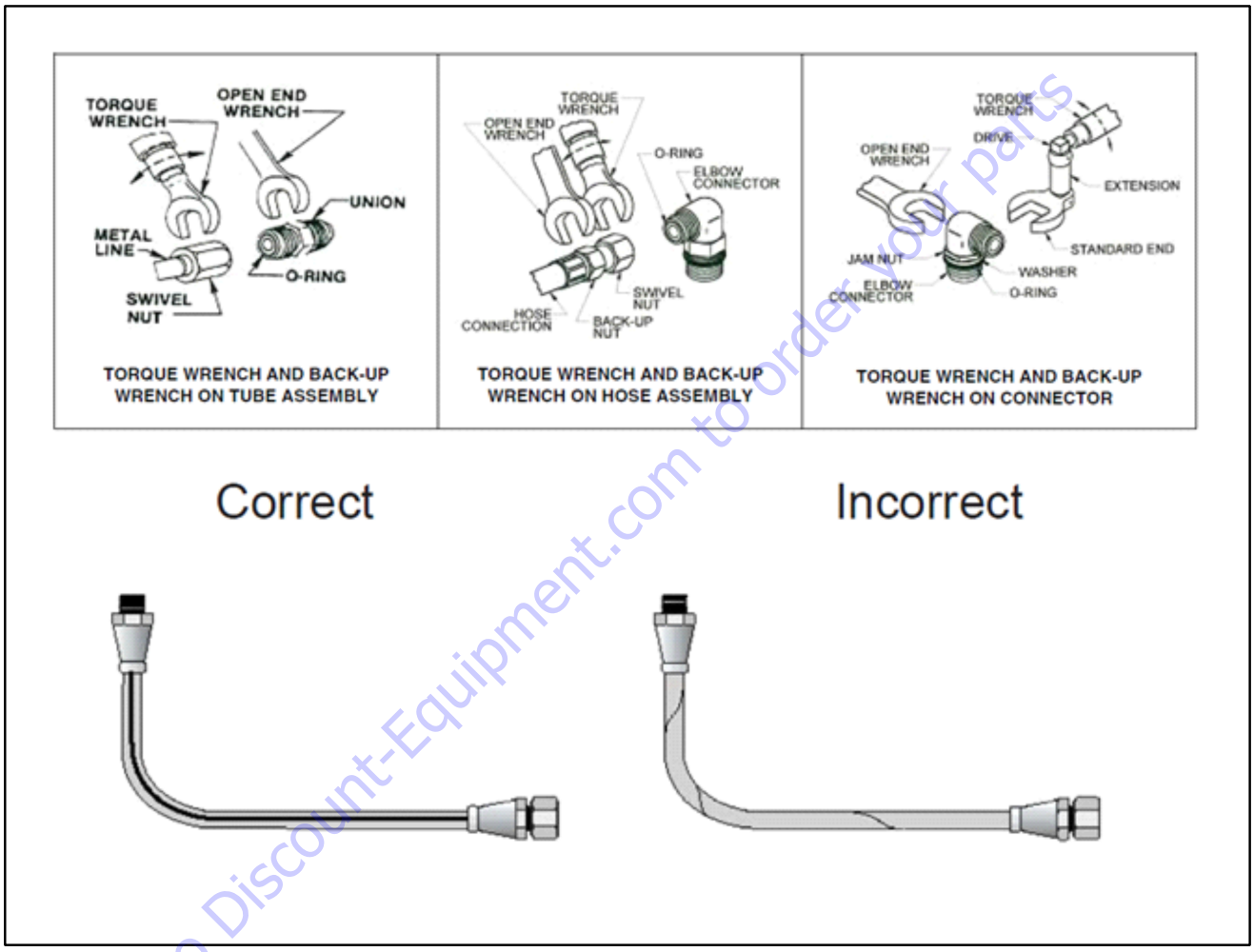


Figure 5-12. Double Wrench Method

FFWR and TFFT Methods

FFWR (FLATS FROM WRENCH RESISTANCE METHOD)

1. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
2. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter. See Figure 5-12.
3. Use the double wrench method per Appendix A, turn the swivel nut to tighten as shown in Figure 5-12. The nut is to be rotated clockwise the number of hex flats as defined by the applicable Table in Section 5.0.
4. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened. See Figure 5-13.

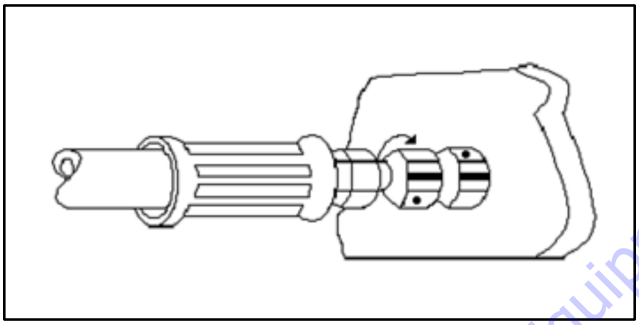


Figure 5-13. FFWR Method

TFFT (TURNS FROM FINGER TIGHT METHOD)

1. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
2. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter.
3. Use the double wrench method per Appendix A, turn the swivel nut to tighten. The nut is to be rotated clockwise the number of turns as defined by the applicable Table in Section 5.0.
4. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened.

Adjustable Stud End Assembly

For Adjustable Stud End Connections; the following assembly steps are to be performed:

1. Lubricate the o-ring with a light coat of hydraulic oil.
2. Position #1 – The o-ring should be located in the groove adjacent to the face of the backup washer. The washer and o-ring should be positioned at the extreme top end of the groove as shown.
3. Position #2 – Position the locknut to just touch the backup washer as shown. The locknut in this position will eliminate potential backup washer damage during the next step.
4. Position #3 – Install the connector into the straight thread box port until the metal backup washer contacts the face of the port as shown.
5. Position #4 – Adjust the connector to the proper position by turning out (counterclockwise) up to a maximum of one turn as shown to provide proper alignment with the mating connector, tube assembly, or hose assembly.
6. Position #5 – Using two wrenches, use the backup wrench to hold the connector in the desired position and then use the torque wrench to tighten the locknut to the appropriate torque.
7. Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.

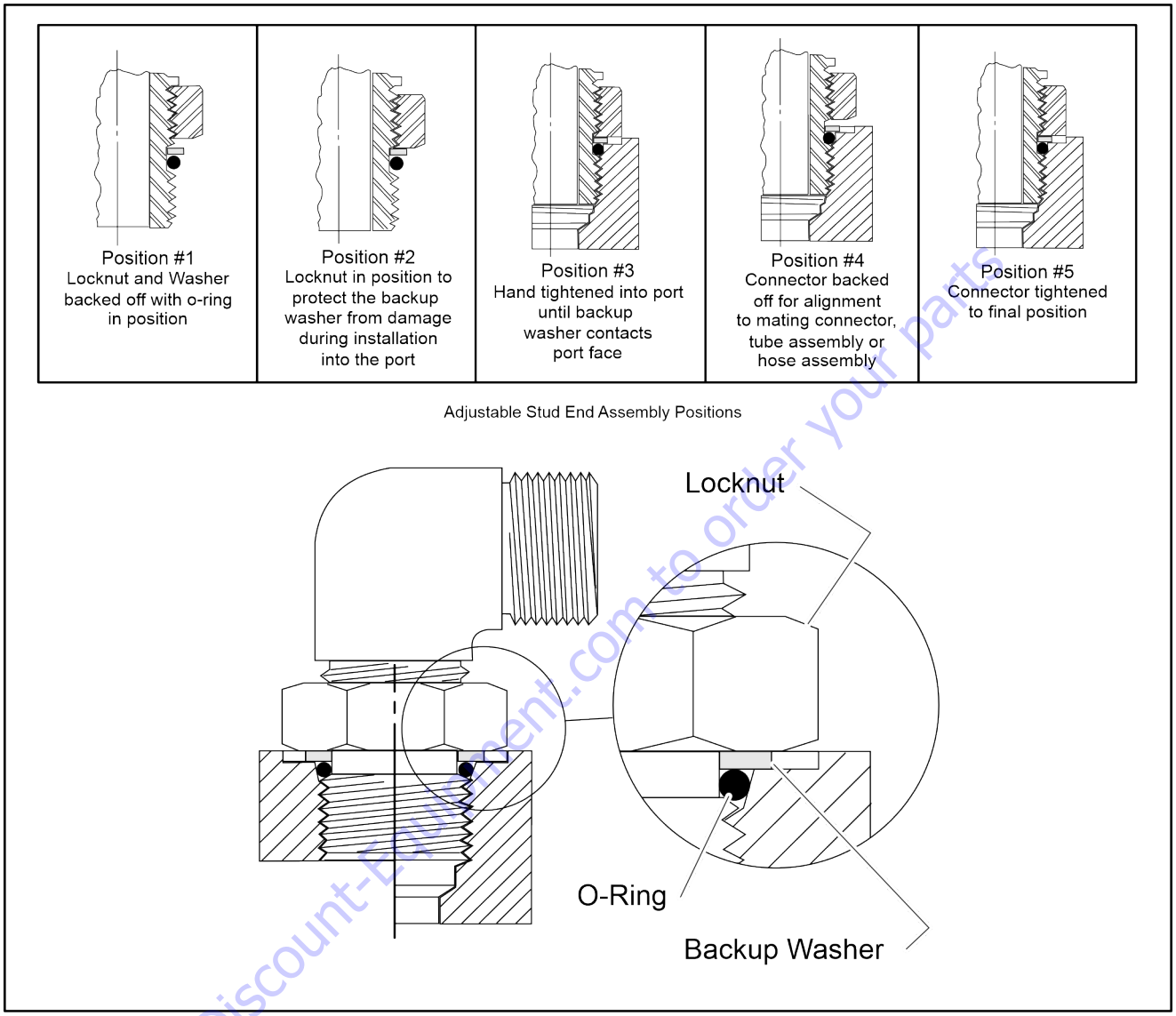


Figure 5-14. Adjustable Stud End Assembly

O-ring Installation (Replacement)

Care must be taken when installing O-rings over threads during replacement or installation. O-rings could become nicked or torn. A damaged O-ring could lead to leakage problems.

1. Inspect O-ring for tears or nicks. If any are found replace O-ring.
2. Ensure proper O-ring to be installed. Many O-rings look the same but are of different material, different hardness, or are slightly different diameters or widths.
3. Use a thread protector when replacing O-rings on fittings.
4. In ORB; ensure O-ring is properly seated in groove. On straight threads, ensure O-ring is seated all the way past the threads prior to installation.
5. Inspect O-ring for any visible nicks or tears. Replace if found.

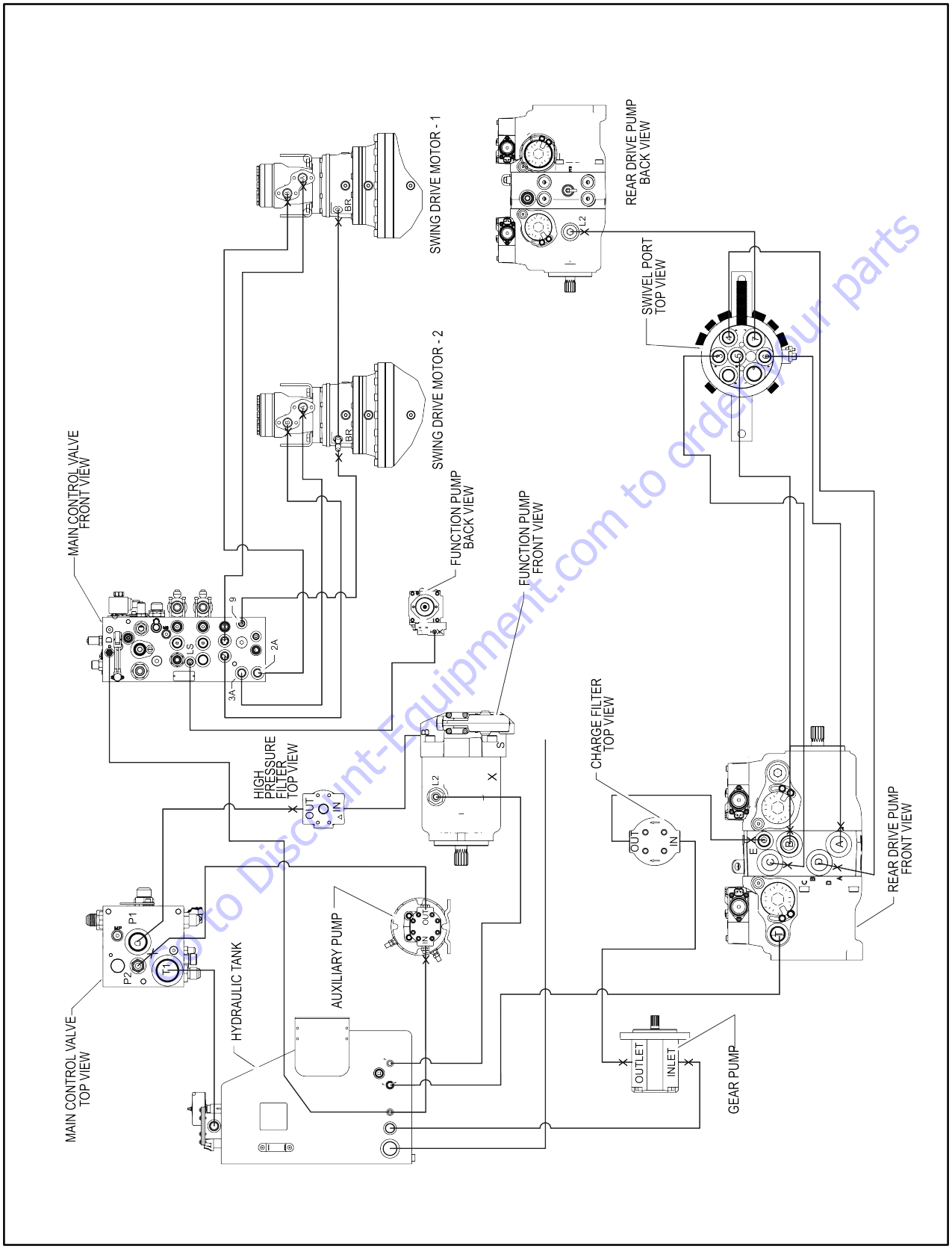


Figure 5-15. Turntable Hydraulic System

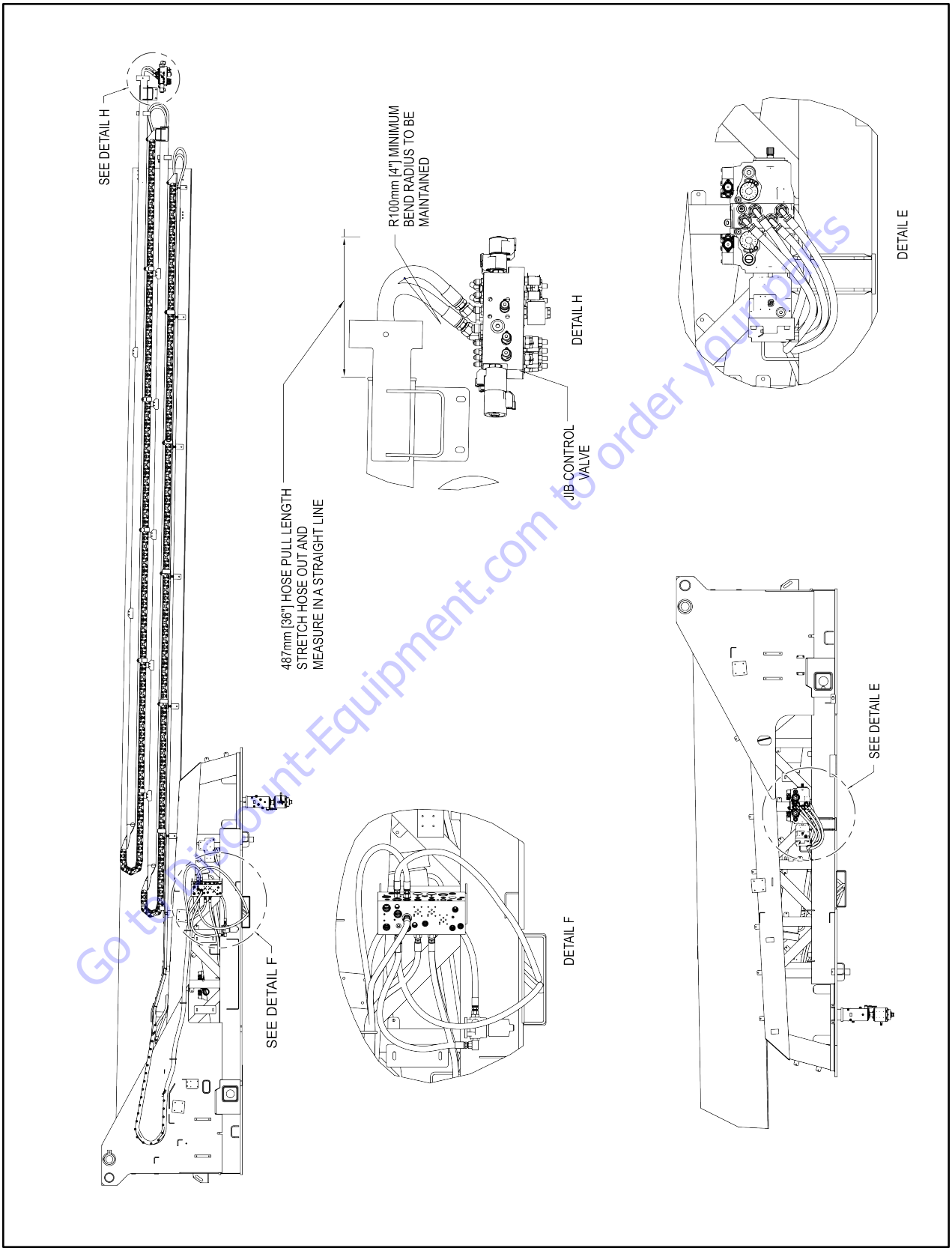


Figure 5-16. Hydraulic Hose Installation - Sheet 1 of 8

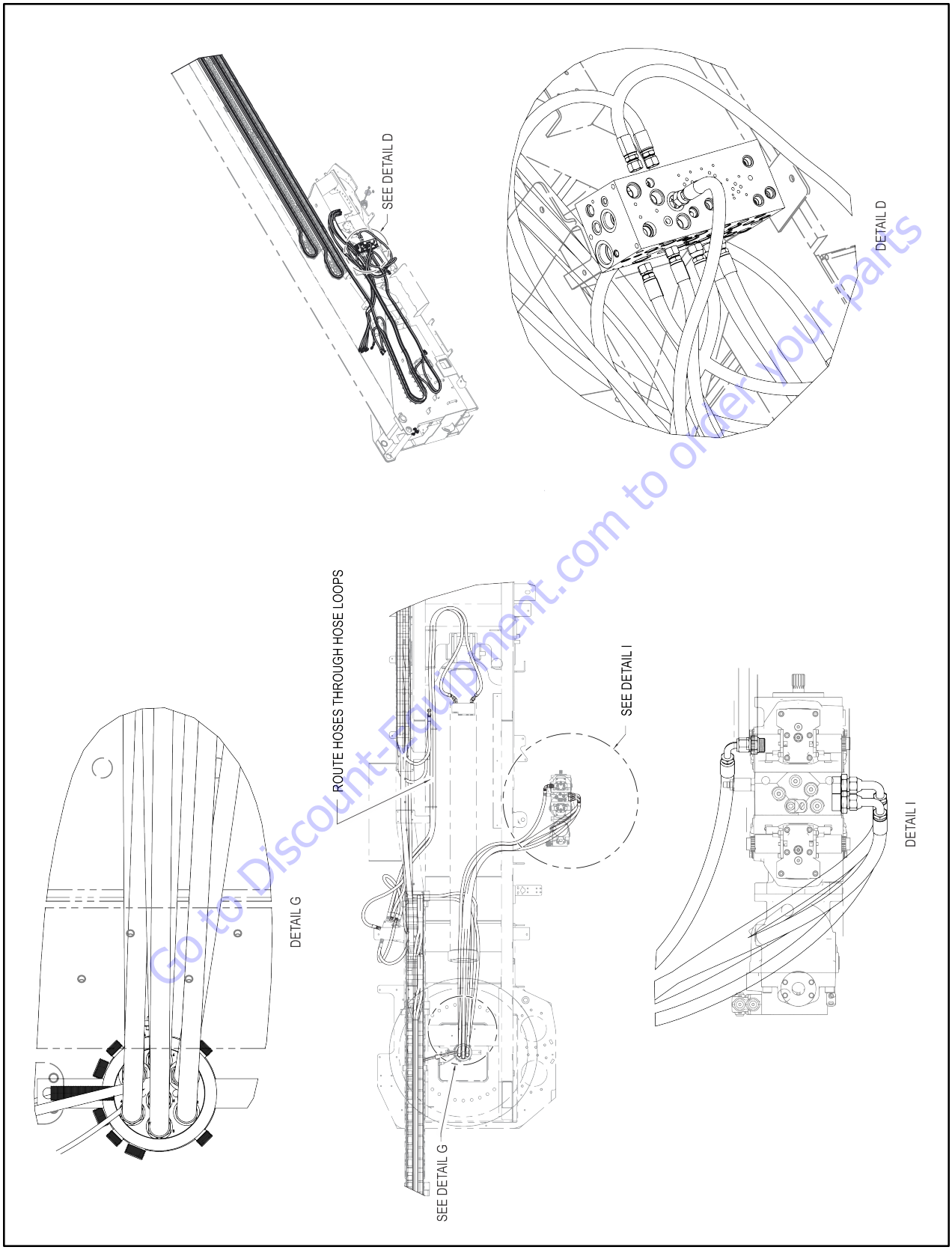


Figure 5-17. Hydraulic Hose Installation - Sheet 2 of 8

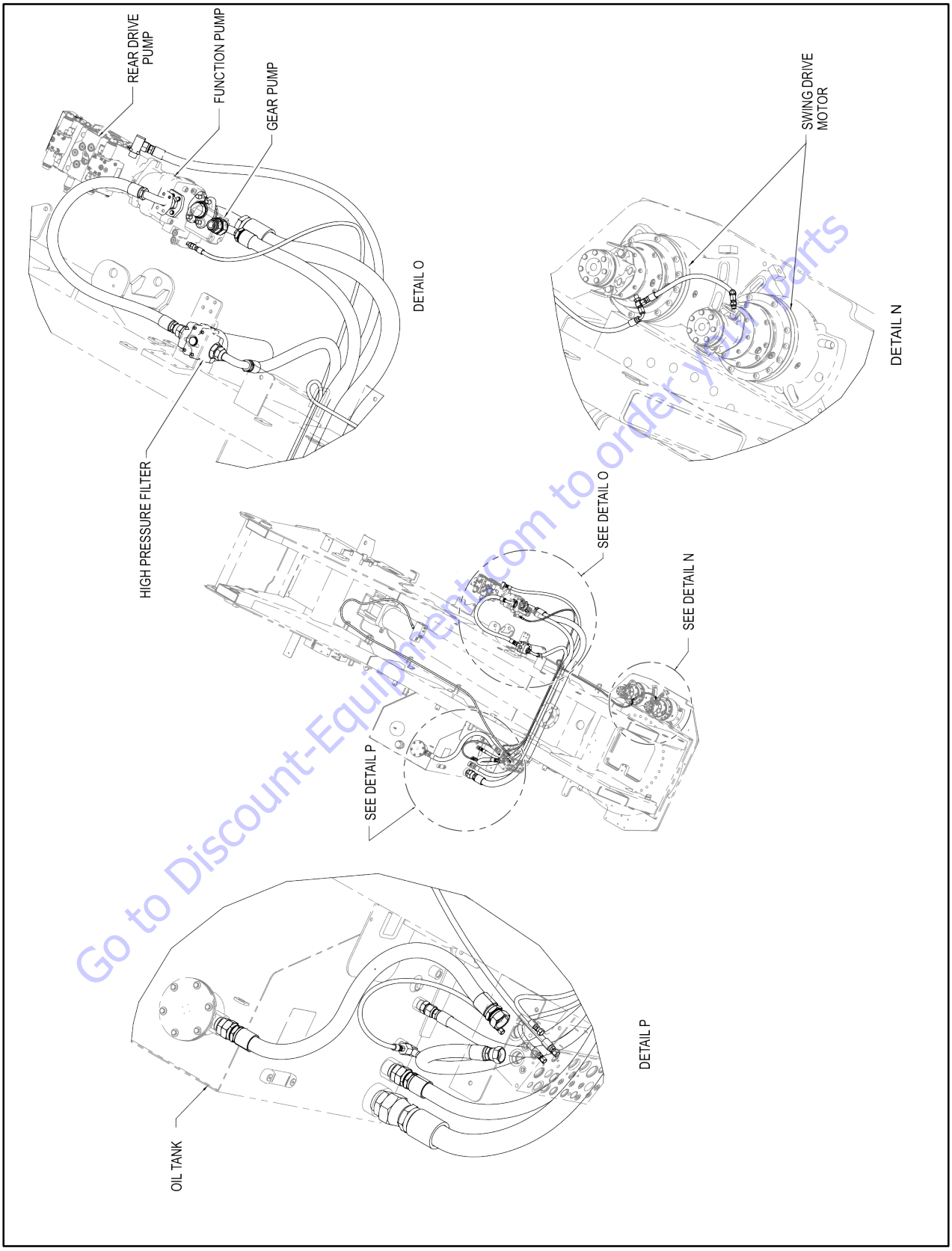


Figure 5-18. Hydraulic Hose Installation - Sheet 3 of 8

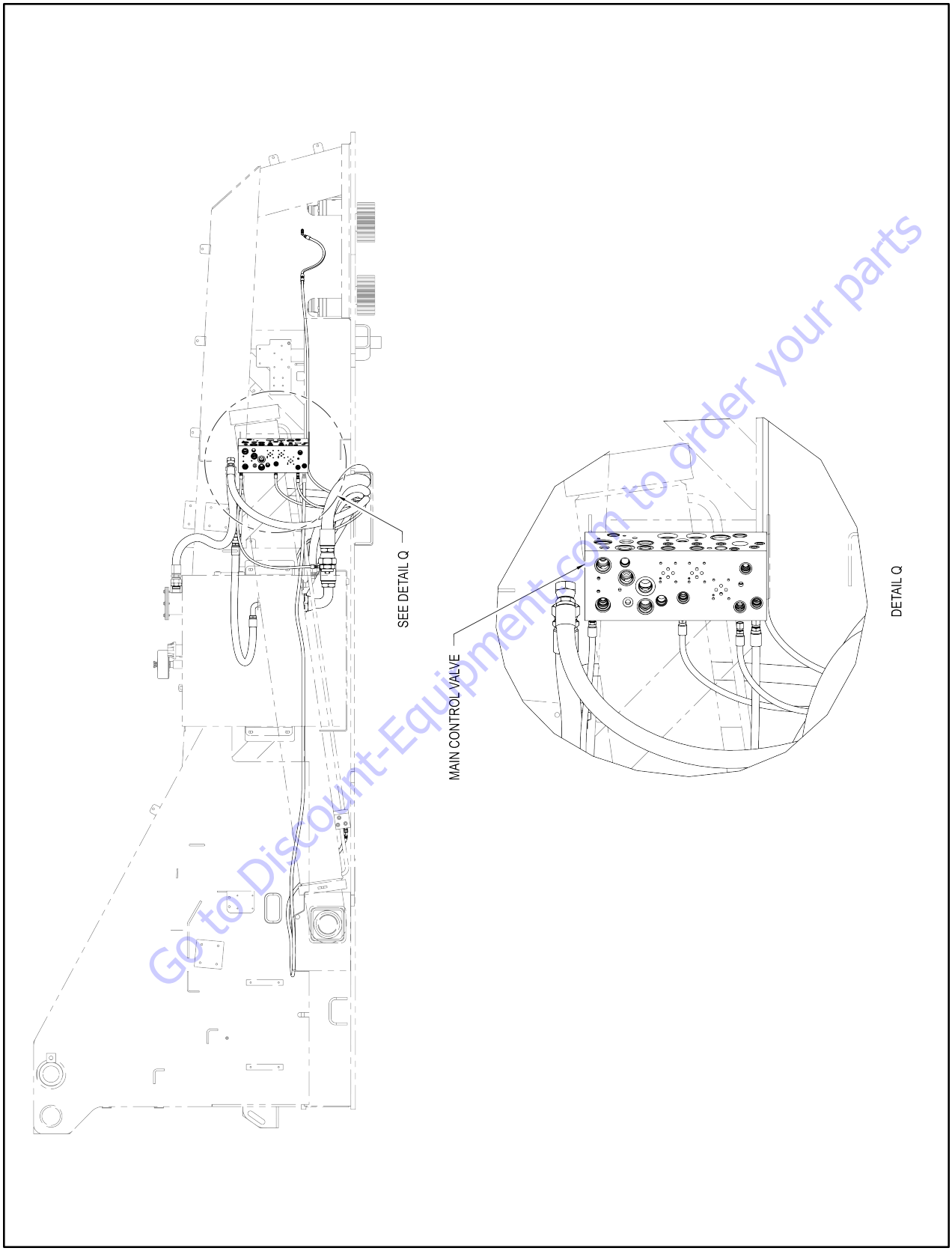


Figure 5-19. Hydraulic Hose Installation - Sheet 4 of 8

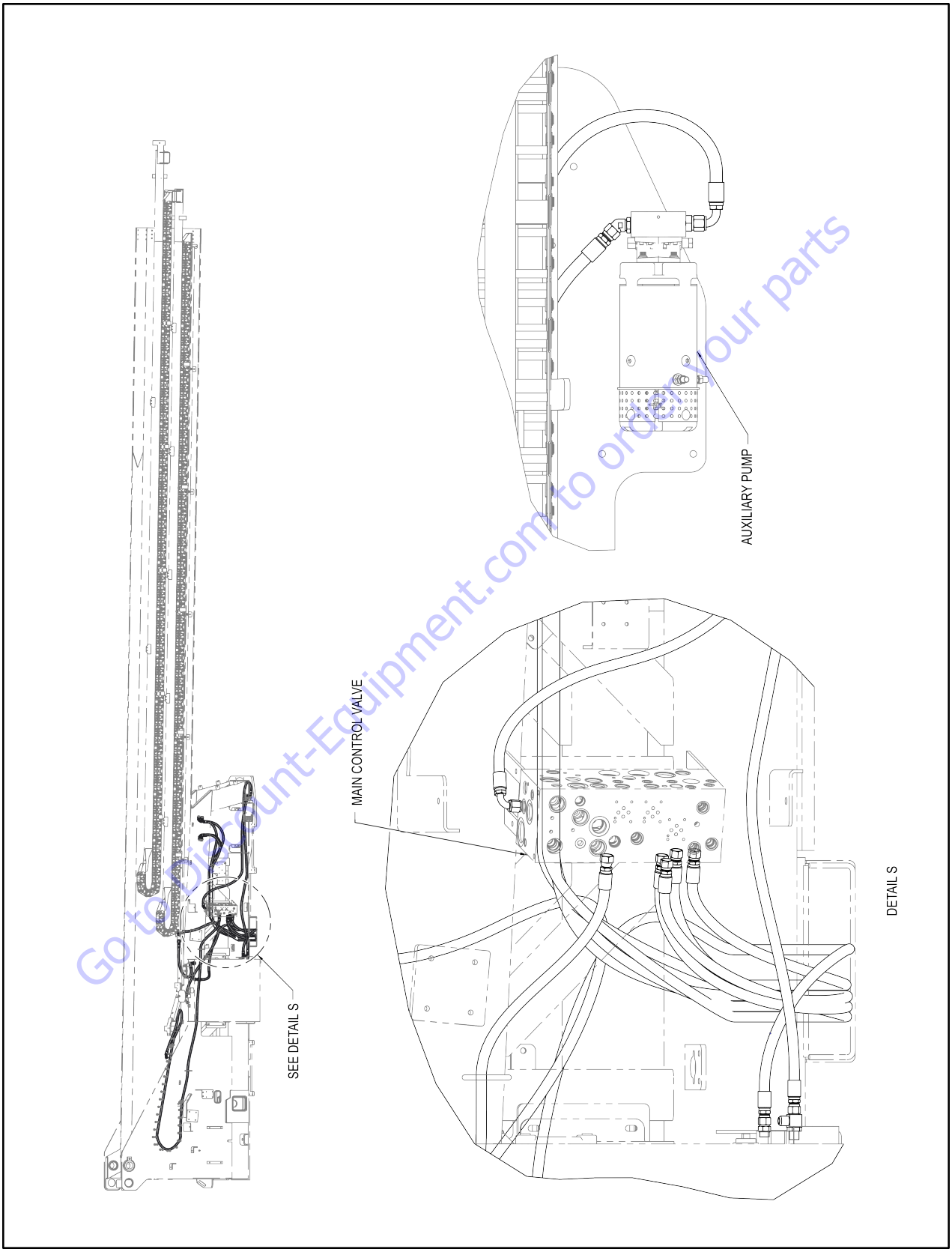


Figure 5-20. Hydraulic Hose Installation - Sheet 5 of 8

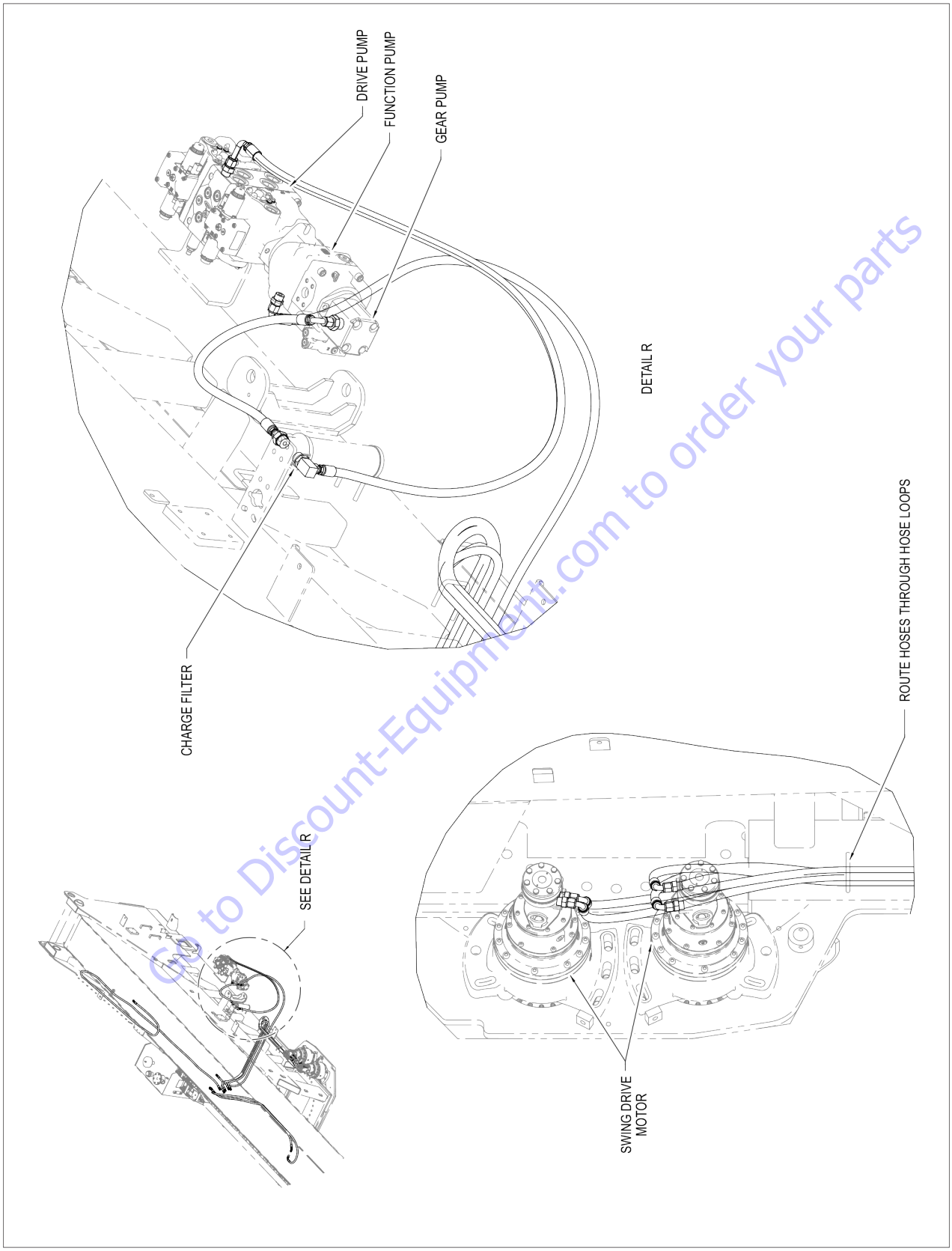


Figure 5-21. Hydraulic Hose Installation - Sheet 6 of 8

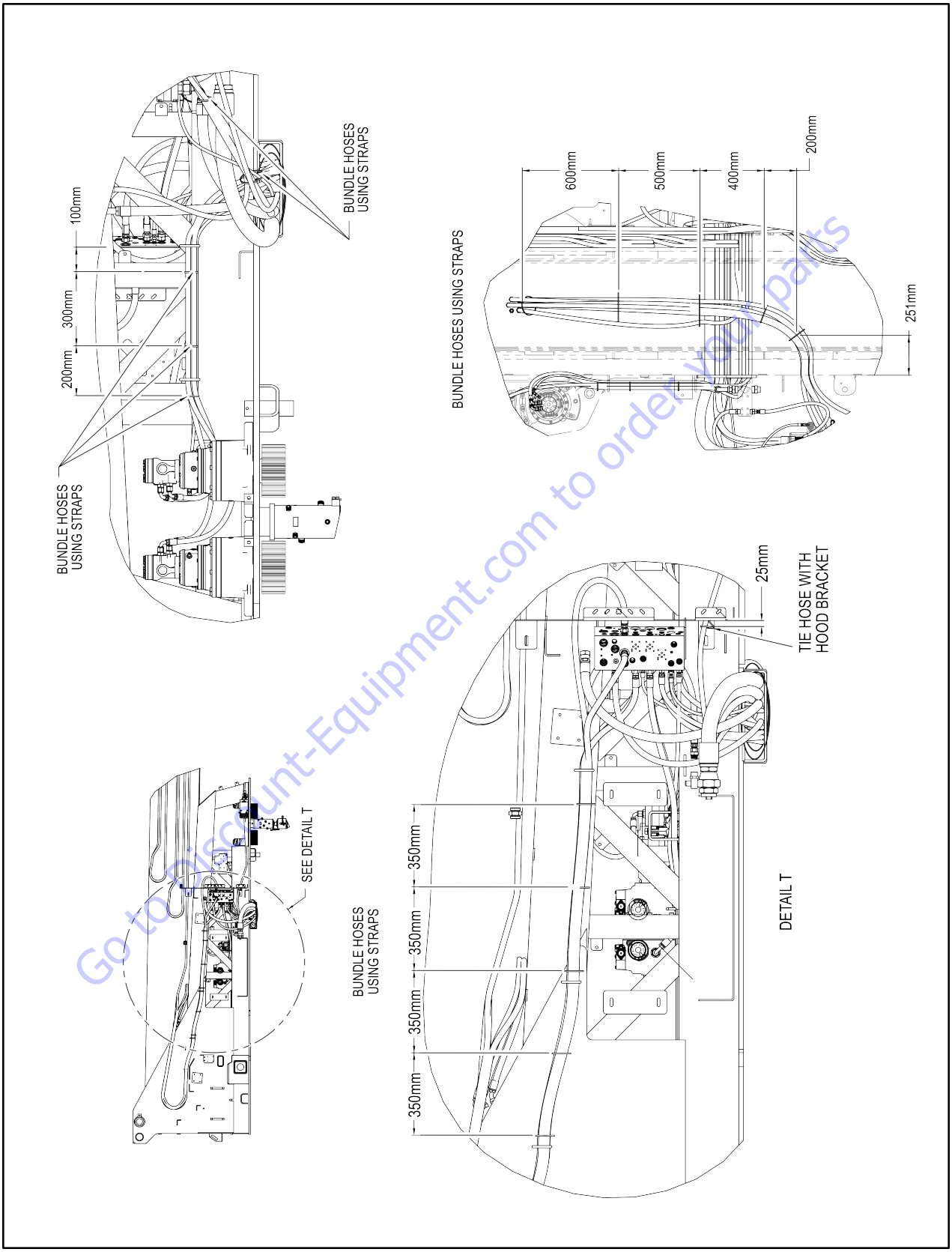


Figure 5-22. Hydraulic Hose Installation - Sheet 7 of 8

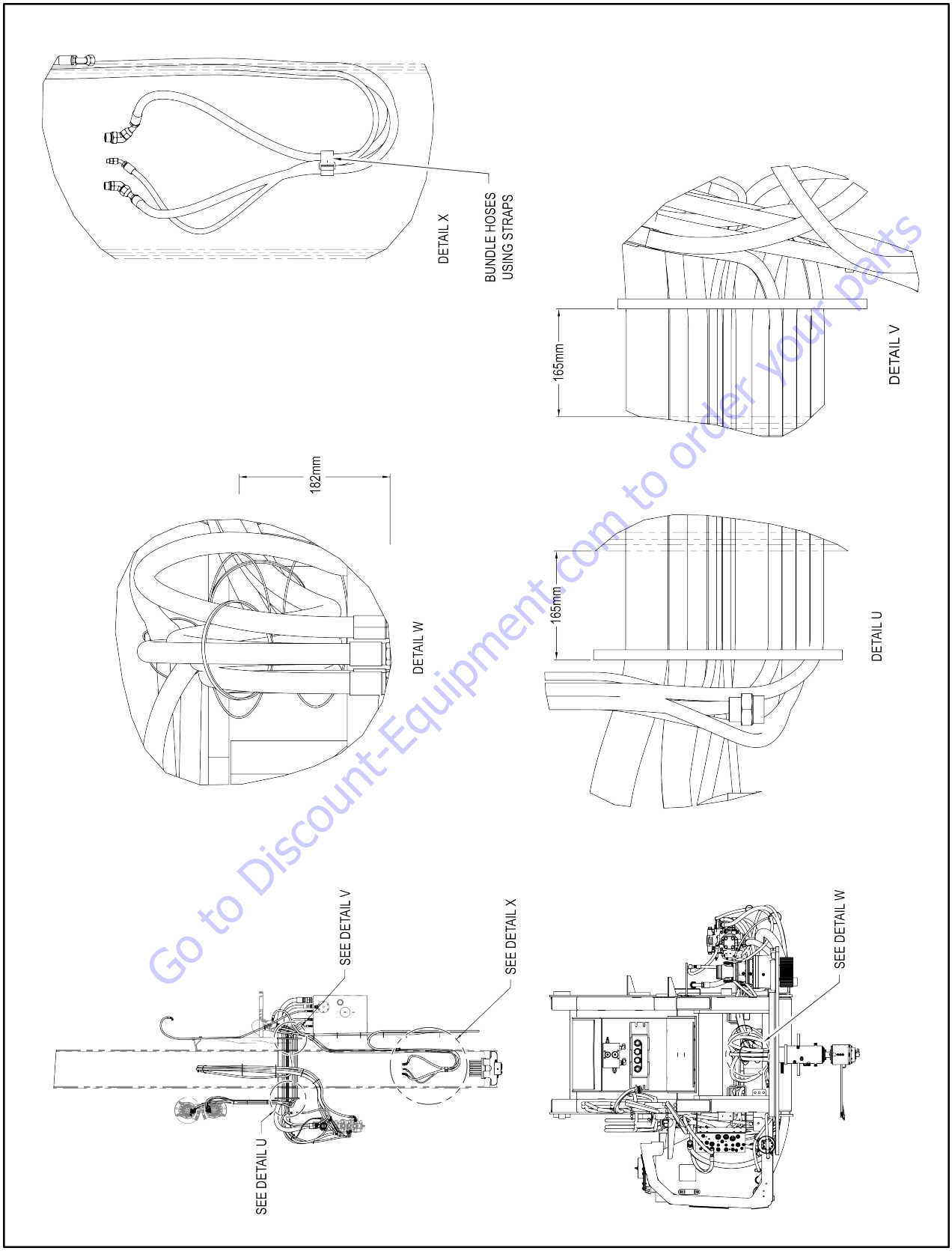


Figure 5-23. Hydraulic Hose Installation - Sheet 8 of 8

5.3 HYDRAULIC CYLINDERS

Axle Extend Cylinder

Refer to Figure 5-27.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod.
3. Remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

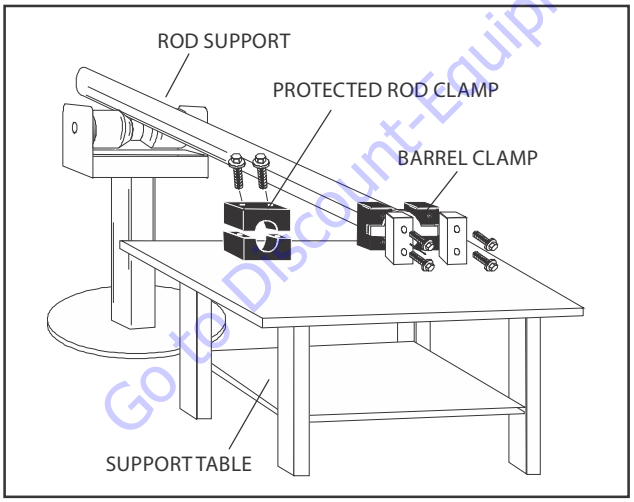


Figure 5-24. Cylinder Barrel Support

5. Mark cylinder head and barrel with center punch marks for later realignment. Remove the capscrews (4).

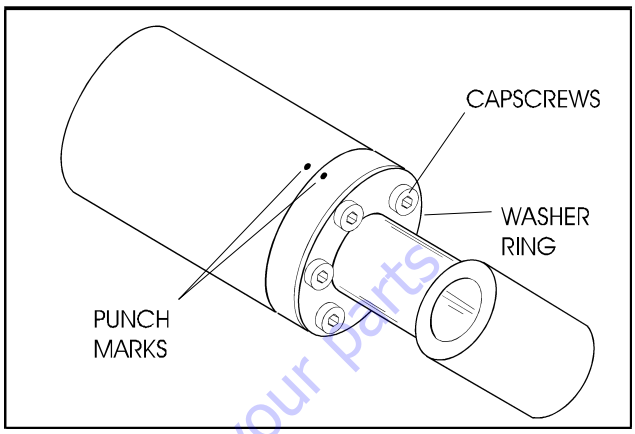


Figure 5-25. Capscrew Removal

6. Attach a suitable pulling device to the cylinder rod end.

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

7. With the barrel clamped securely, carefully withdraw the complete rod assembly from the cylinder barrel (2).

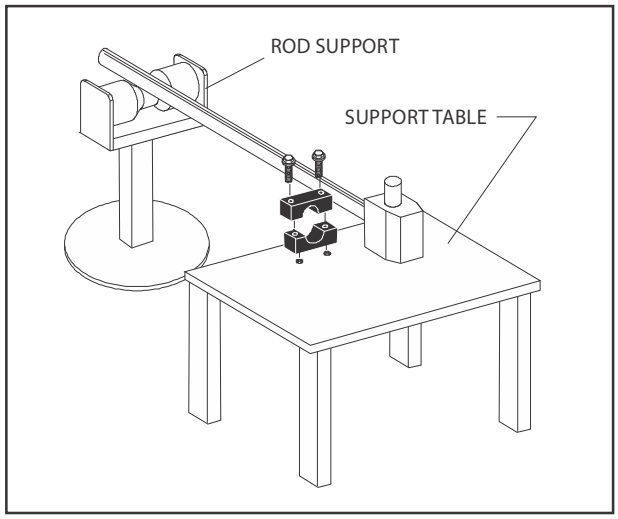
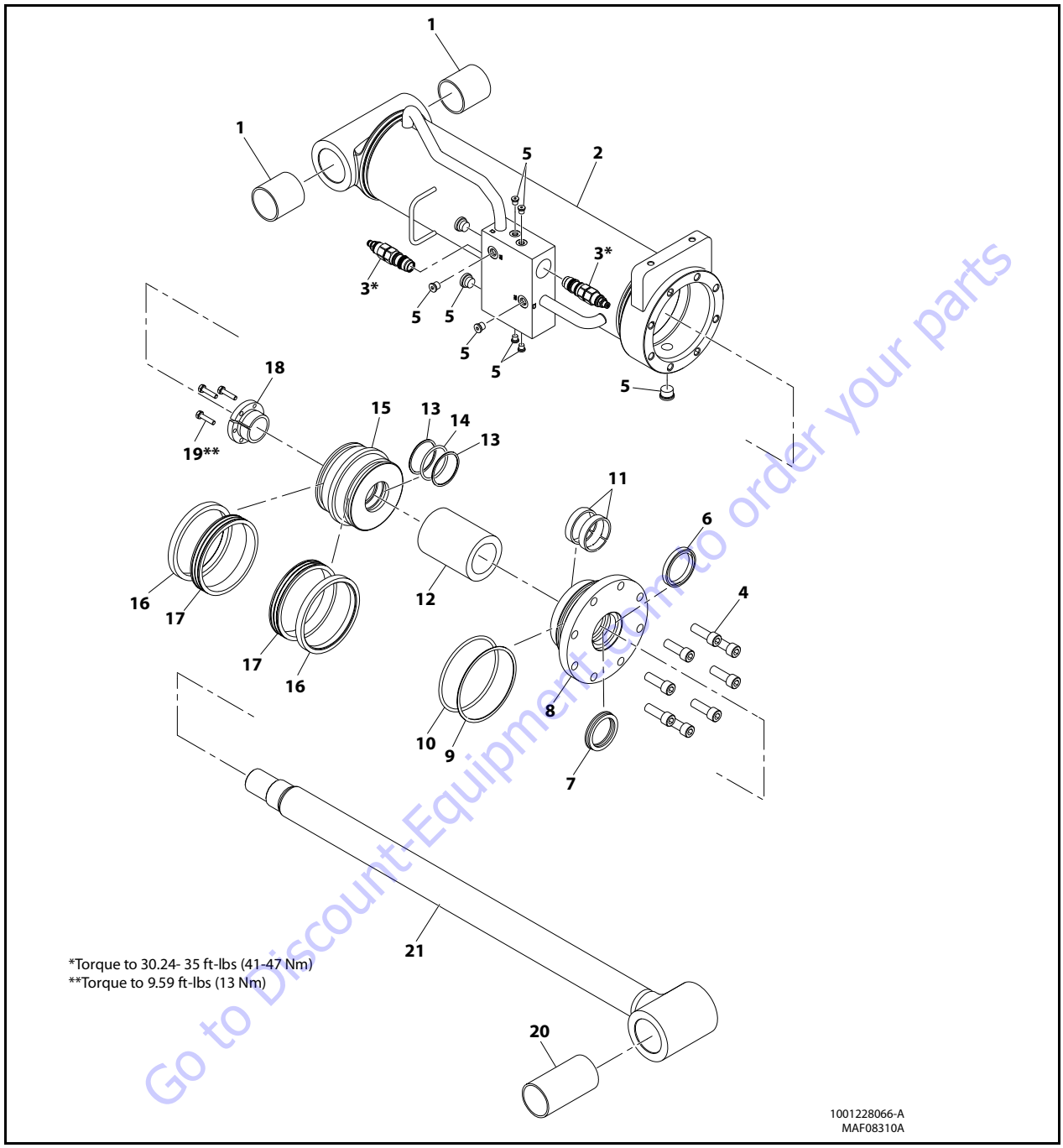


Figure 5-26. Cylinder Rod Support

8. Using suitable protection, clamp the cylinder rod (21) in a vise or holding fixture as close to the piston (15) as possible.



1. Bushing
2. Barrel
3. Counterbalance Valve
4. Capscrew
5. O-Ring
6. Wiper Seal
7. Seal
8. Cylinder Head
9. Backup Ring
10. O-Ring
11. Wear Ring
12. Spacer
13. Backup Ring
14. O-Ring
15. Piston
16. Lock Ring
17. Seal
18. Tapered Bushing
19. Bolt
20. Bushing
21. Rod

Figure 5-27. Axle Extend Cylinder Assembly

9. Loosen and remove bolts from tapered bushing (18) and piston (15).

10. Insert bolts in threaded holes in outer piece of tapered bushing (18). Progressively tighten bolts until bushing is loose. Remove tapered bushing (18) from piston (15).

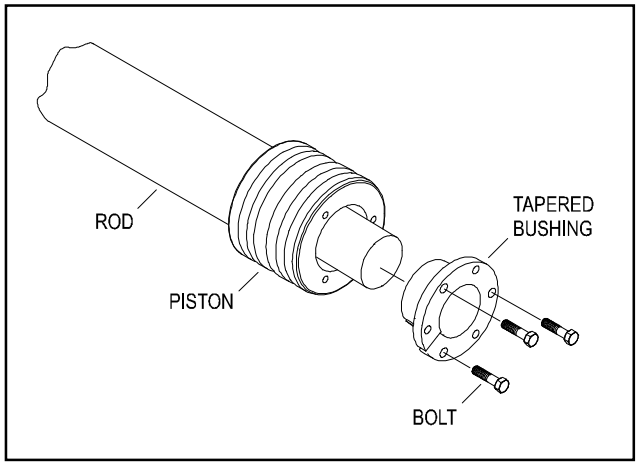


Figure 5-28. Tapered Bushing Removal

11. By hand, screw the piston (15) counterclockwise and remove it from cylinder rod (21).

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

12. Remove and discard backup ring, o-ring, and backup ring from inside grooves of piston (15). Remove and discard two lock rings and seals from outer grooves of piston (15).

13. Remove piston spacer from rod.

14. Remove rod (21) from holding fixture.

15. Remove and discard two wear rings (11), wiper seal (6) and rod seal (7) from inside of cylinder head (8). Remove and discard O-ring and backup ring (9) from outer groves of cylinder head (8).

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.

2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.

3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.

4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.

5. Inspect threaded portion of barrel for damage. Dress threads as necessary.

6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.

7. Inspect threaded portion of piston for damage. Dress threads as necessary.

8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.

9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.

10. Inspect threaded portion of head for damage. Dress threads as necessary.

11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.

12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.

13. Inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.

    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.

    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.

    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

d. Press bushing in barrel or rod bushing with correct size arbor.

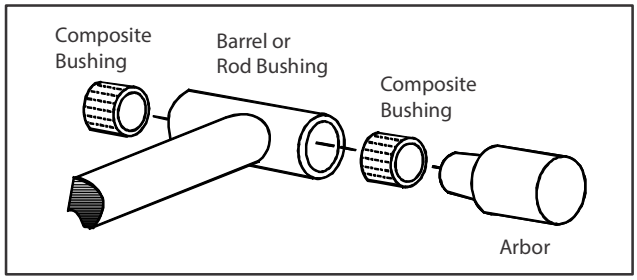


Figure 5-29. Bushing Installation

14. Inspect spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.

15. Inspect port block fittings and holding valves. Replace as necessary.

16. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

1. Install backup ring (9) and o-ring (10) in outside diameter grooves of cylinder head (8).

2. Install rod seal (7), wiper ring (6), and wear rings (11) in cylinder head (8) as shown.

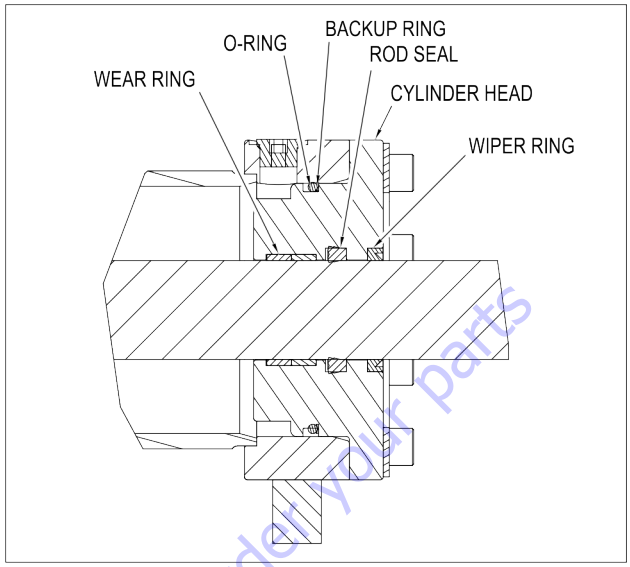


Figure 5-30. Cylinder Head Seal Installation

3. Install cylinder head assembly (8) on rod. Do not damage or dislodge wiper (6) and rod seals (7). Push cylinder head (8) to rod end (21).

4. Install spacer (12) on rod (21).

5. Install backup ring (13), O-ring (14), and backup ring (13) in inside grooves of piston (15).

6. Install hydrolock seals (17) and guidelock rings (16) in outer grooves of piston (15).

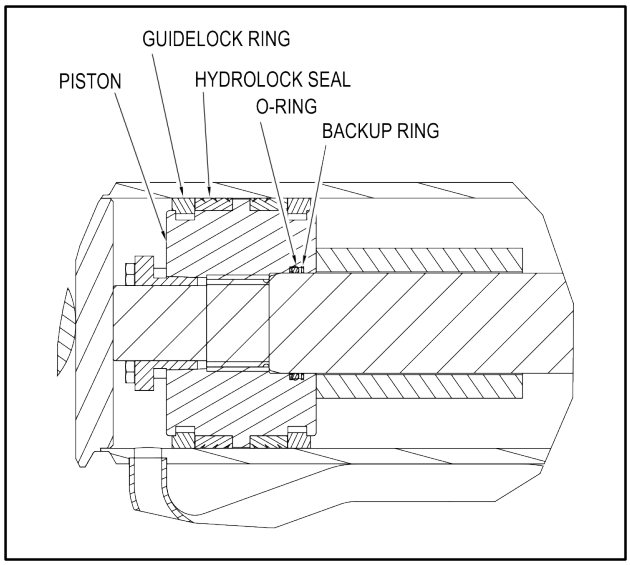


Figure 5-31. Piston Seal Kit Installation

7. Using suitable protection, clamp cylinder rod (21) in a vise or similar holding fixture as close to piston (15) as possible.

8. Thread piston (15) on cylinder rod (21) hand tight. Ensure O-ring (14) and backup rings (13) are not damaged or dislodged.

NOTE: *When installing the tapered bushing, piston and mating end of rod must be free of oil.*

9. Assemble the tapered bushing (18) loosely into the piston (15) and insert capscrews (19) through the drilled holes in the bushing and into the tapped holes in the piston (15).

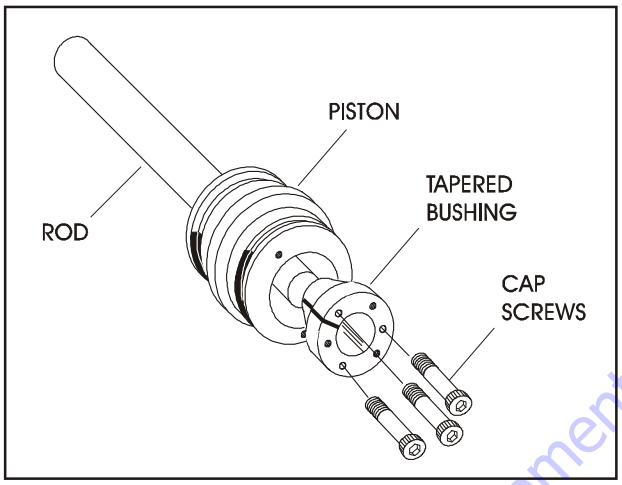


Figure 5-32. Tapered Bushing Installation

10. Tighten the capscrews (19) evenly and progressively in rotation to 9.59 ft.lbs (13 Nm).

11. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;

    a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.

    b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

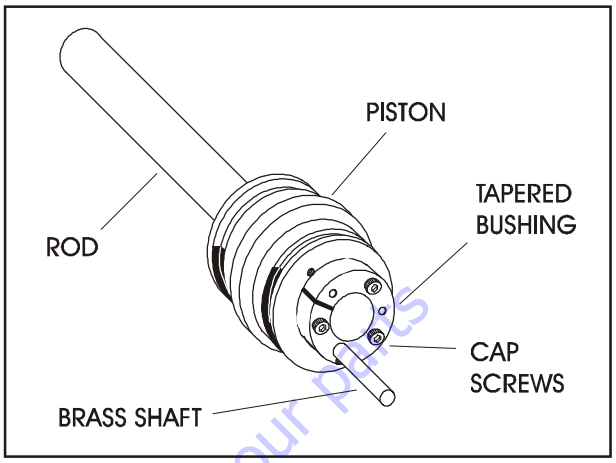


Figure 5-33. Seating the Tapered Bearing

12. Retorque the capscrews (4) evenly and progressively in rotation to 9 ft.lbs (12 Nm).

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

13. Clamp barrel (2) securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston O-ring and seal ring.

14. Continue pushing rod (21) in barrel (2) until cylinder head (8) can be inserted into barrel cylinder.

NOTE: *Apply locking primer and Medium strength threadlocking compound to capscrews.*

15. Secure cylinder head (8) with capscrews (4).

16. Install two counterbalance valves (3) with new O-rings in valve block. Torque to 30.24-35 ft-lbs (41-47 Nm).

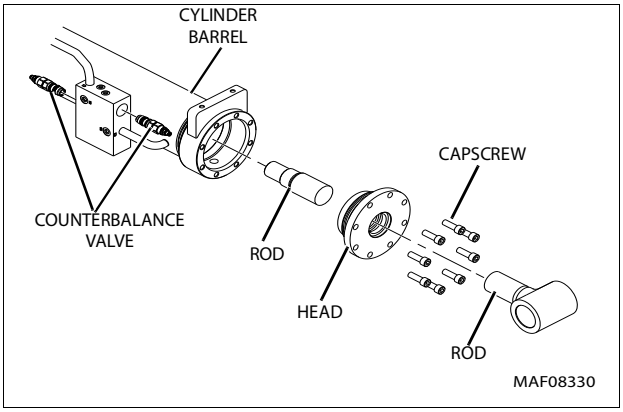


Figure 5-34. Rod Assembly Installation

Jib Level (Slave) Cylinder

Refer to Figure 5-38.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod.
3. Remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

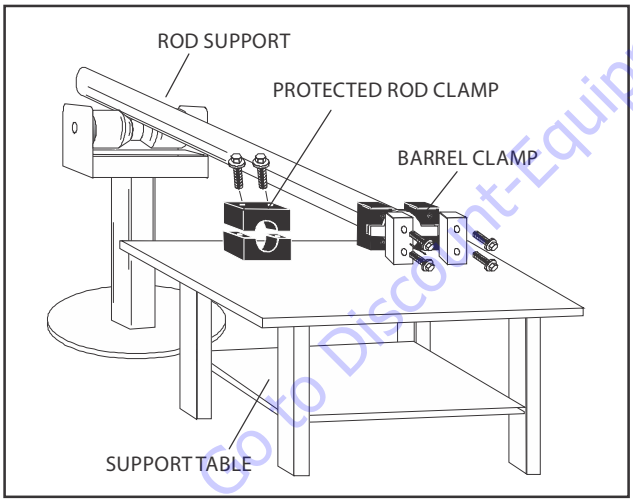


Figure 5-35. Cylinder Barrel Support

5. Unscrew cylinder head with hook spanner wrench.

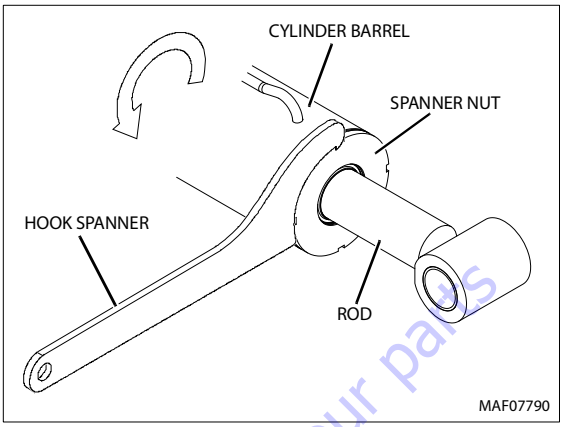


Figure 5-36. Cylinder Head Removal

6. Attach a suitable pulling device to the cylinder rod port-block end or cylinder rod end, as applicable.

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

7. Clamp barrel securely. Unscrew cylinder head and pull rod assembly from barrel.
8. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

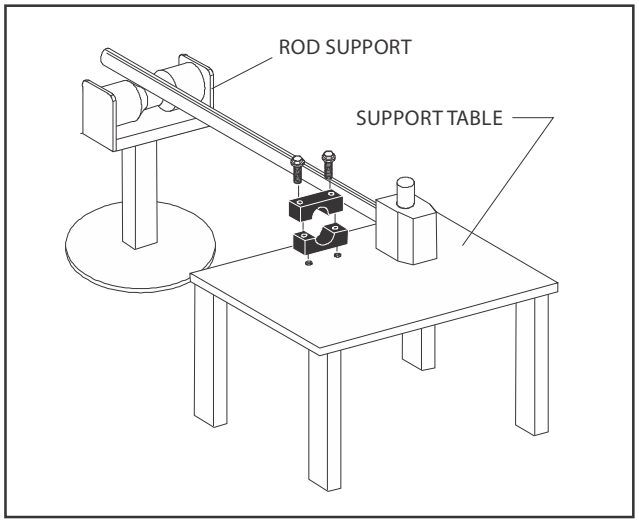
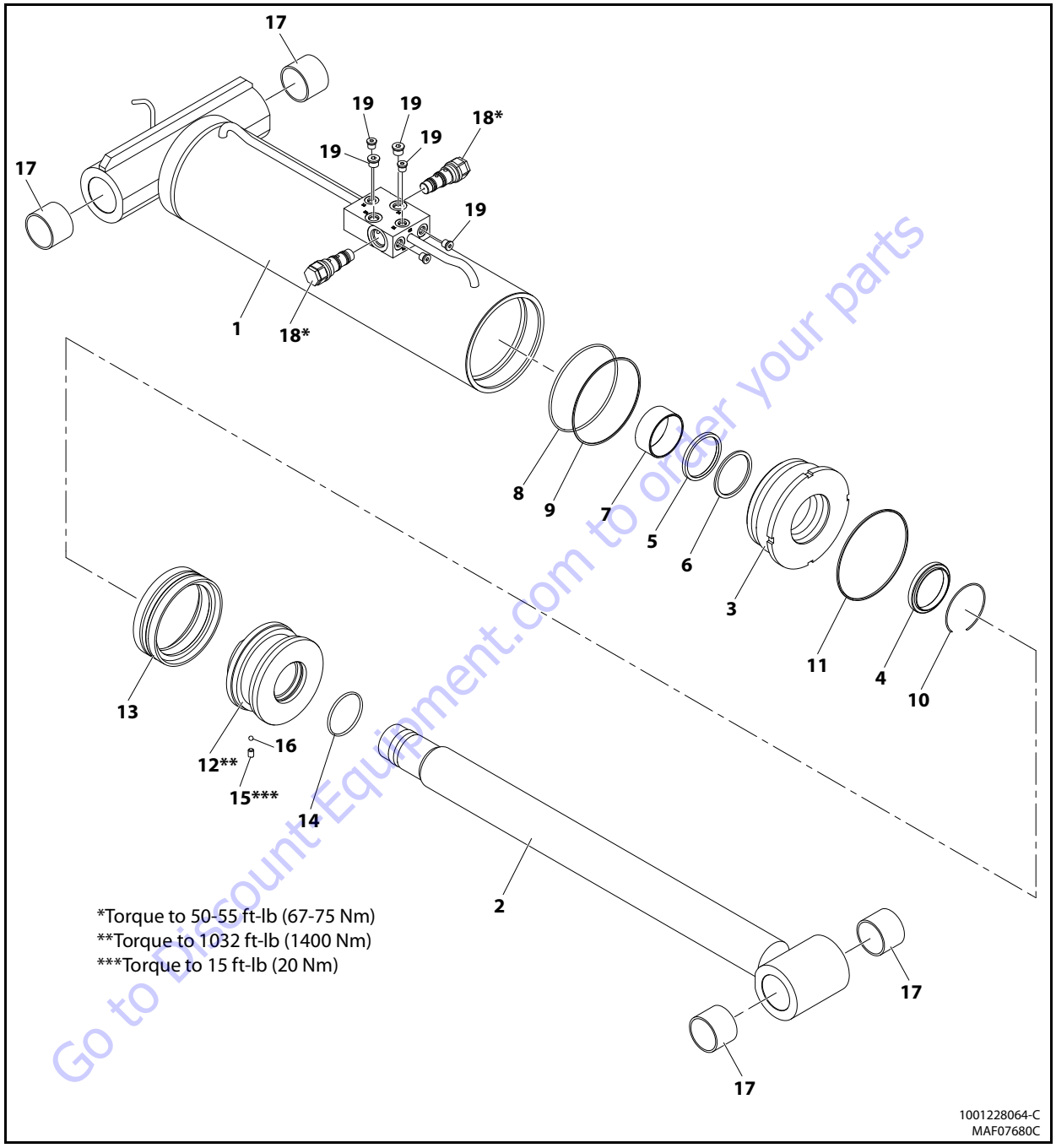


Figure 5-37. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Rod Seal
6. Backup Ring
7. Wear Ring
8. O-Ring
9. Backup Ring
10. Retainer
11. O-Ring
12. Piston
13. Seal, Piston
14. O-Ring
15. Setscrew
16. Steel Ball
17. Bushing
18. Counterbalance Valve
19. Plug

Figure 5-38. Jib Level (Slave) Cylinder Assembly

9. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
10. Loosen and remove the setscrew (15) and ball (16) which attaches the piston to the rod.
11. Screw the piston (12) counterclockwise and remove the piston from cylinder rod (2).

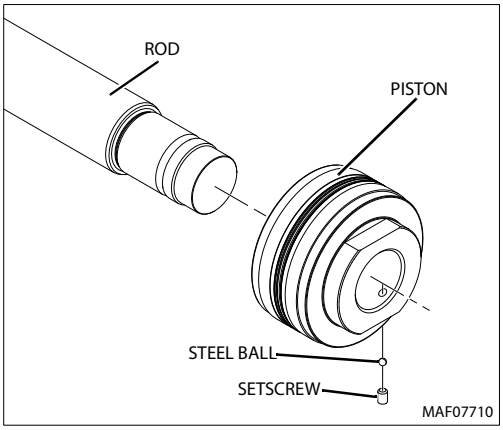


Figure 5-39. Piston Removal

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

12. Remove and discard the piston seal (13) from outside grooves of piston (12).
13. Remove and discard the o-ring (14) from inside grooves of piston (12).

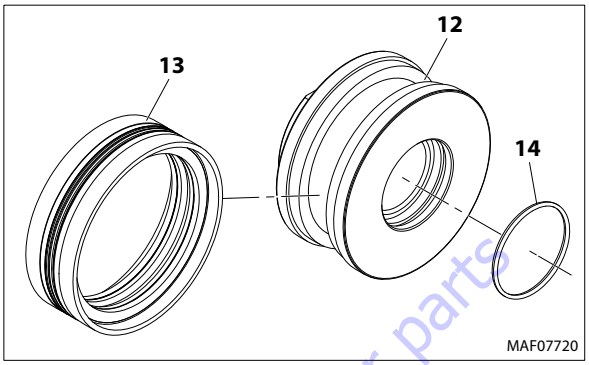


Figure 5-40. Piston Seal Disassembly

14. Remove rod from holding fixture and remove cylinder head (3).
15. Remove and discard wear ring (7), wiper seals (4), retainer ring (10), backup ring (6) and rod seal (5) from inside of cylinder head (3).
16. Remove and discard O-ring (8), backup ring (9) and O-ring (11) from outside groves of cylinder head (3).

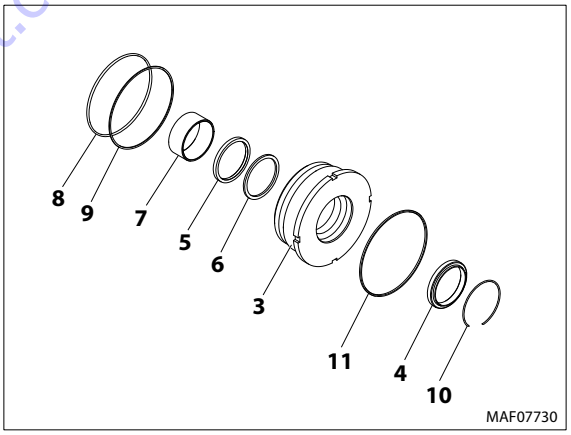


Figure 5-41. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. Inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

    d. Press bushing in barrel or rod bushing with correct size arbor.

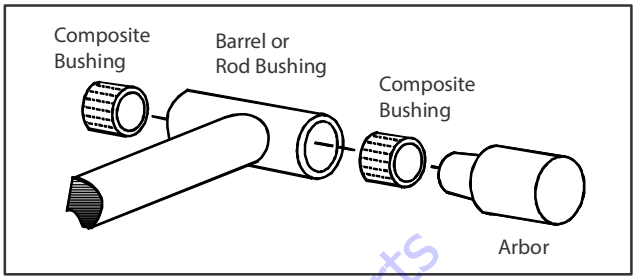


Figure 5-42. Bushing Installation

14. Inspect spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
15. Inspect port block fittings and holding valves. Replace as necessary.
16. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

NOTE: *Apply a light film of hydraulic oil to all components before assembly.*

1. A special tool is used to install a new rod seal into the applicable cylinder head groove.

NOTICE

WHEN INSTALLING NEW SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head groove. Install a new bearing into the applicable inside diameter of the cylinder head groove.

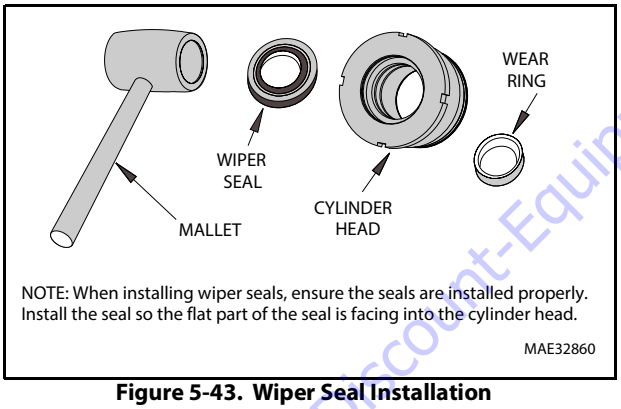


Figure 5-43. Wiper Seal Installation

3. Install wear ring (7), wiper seals (4), retainer ring (10), backup ring (6) and rod seal (5) in inside groves of cylinder head (3).

4. Install o-ring (8), backup ring (9) and o-ring (11) in outside groves of cylinder head (3).

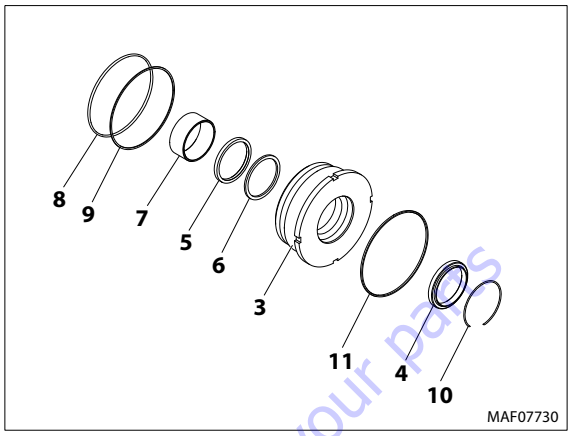


Figure 5-44. Cylinder Head Assembly

5. Carefully install the cylinder head (3) on the rod (2), ensuring that the wiper seal (4), wear ring (7), backup rings (6), rod seal (5) and backup rings (9) are not damaged or dislodged. Push the head (3) along the rod (2) to the rod end, as applicable.

6. Using suitable protection, clamp the cylinder rod (2) in a vise or similar holding fixture as close to piston as possible.

7. Place new o-ring (14) in the inside diameter of the piston (12).

8. Carefully thread the piston (12) on the cylinder rod (2), ensuring that the o-ring (14) and seal (13) are not damaged or dislodged.
   Torque piston (12) to 1032 ft-lb (1400 Nm).

9. Install the setscrew (15) and ball (16) on the piston and attach the piston on the rod.
   Torque setscrew (15) to 15 ft-lb (20 Nm).

10. Remove the cylinder rod (2) from the holding fixture.

11. Place new piston seal (13) in the outer diameter of piston (12) groove. (A tube, with I.D. slightly larger than the O.D. of the piston is recommended to install the solid seal).

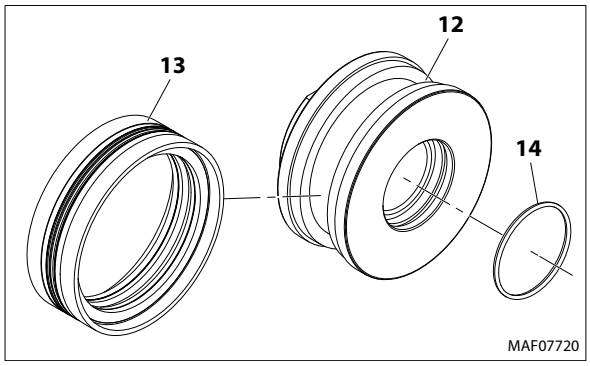


Figure 5-45. Piston Seal Installation

12. Position the cylinder barrel in a suitable holding fixture.

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

13. With barrel clamped secured and adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and piston seal is not damaged or dislodged.

14. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.

15. Screw the cylinder head into the barrel using a hook spanner wrench.

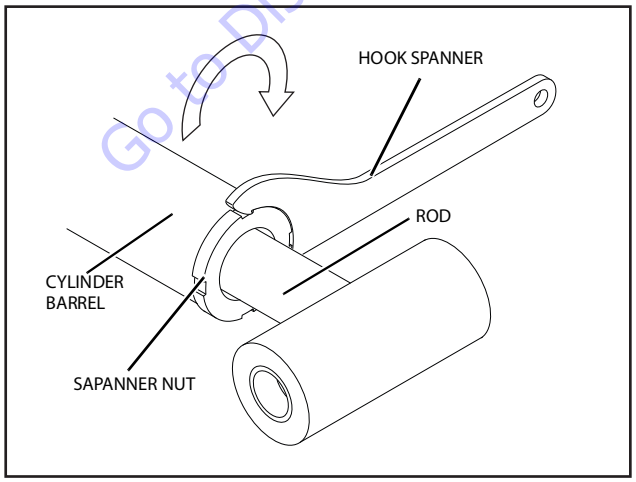


Figure 5-46. Cylinder Head Tightening

16. Caulk at the machined area of the cylinder barrel end so that it locks the cylinder head in place and it does not unscrew from the barrel.

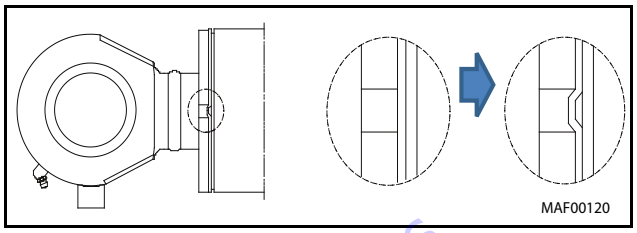


Figure 5-47. Caulking

17. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any plugs.

18. Install the plugs (19) in the cylinder ports.

19. Install two counterbalance valves (3) with new O-rings in valve block. Torque to 50-55 ft-lb (67-75 Nm).

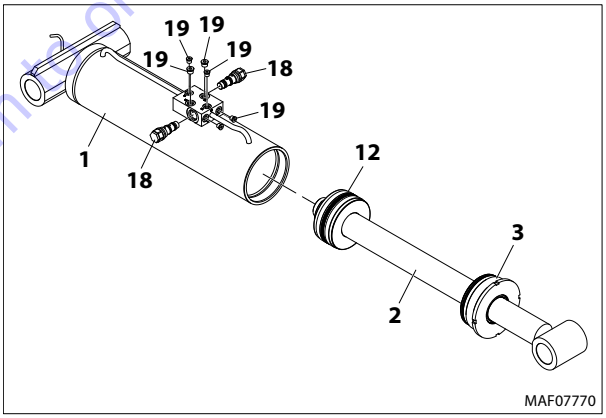


Figure 5-48. Rod Assembly Installation

Platform Level Cylinder

Refer to Figure 5-52.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port fitting.
2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.
3. Place cylinder barrel in a suitable holding fixture.

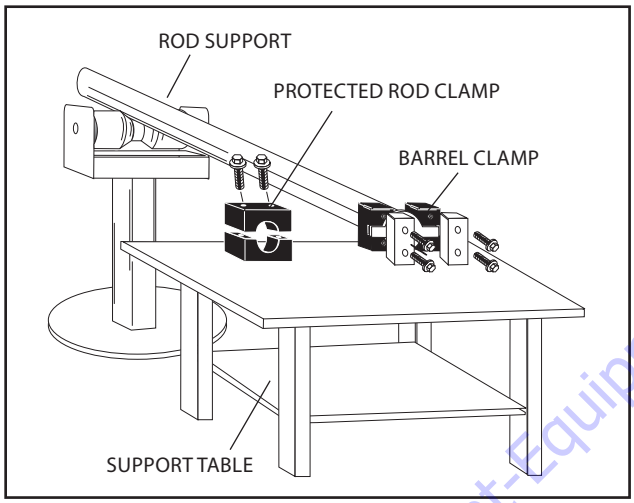


Figure 5-49. Cylinder Barrel Support

4. Remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
5. If necessary, remove eight capscrews (8) and retainer cap (7). Remove O-Ring plug (12). Remove cylinder length sensor assembly (6) from barrel (3).

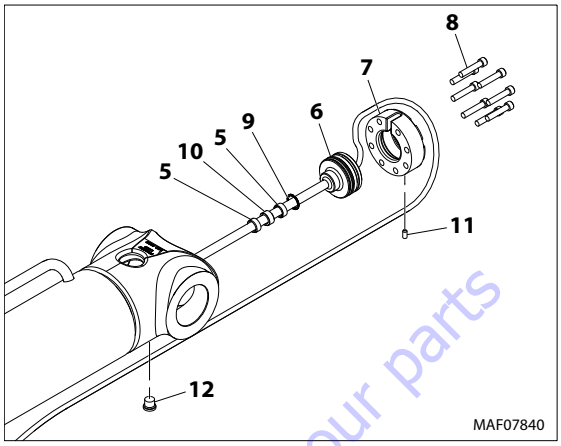


Figure 5-50. Cylinder Length Sensor Removal

6. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.
7. Mark cylinder head and barrel with center punch marks for later realignment. Unscrew cylinder head with hook spanner wrench.

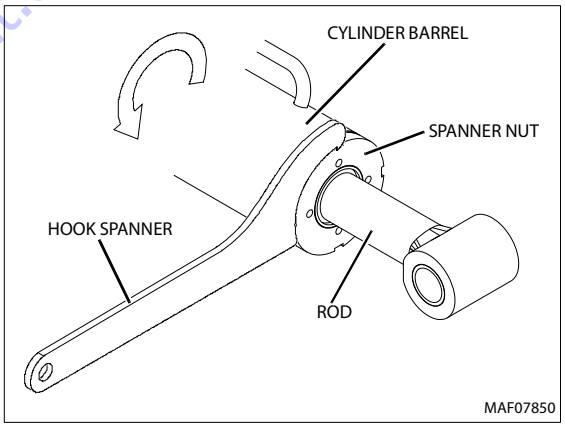
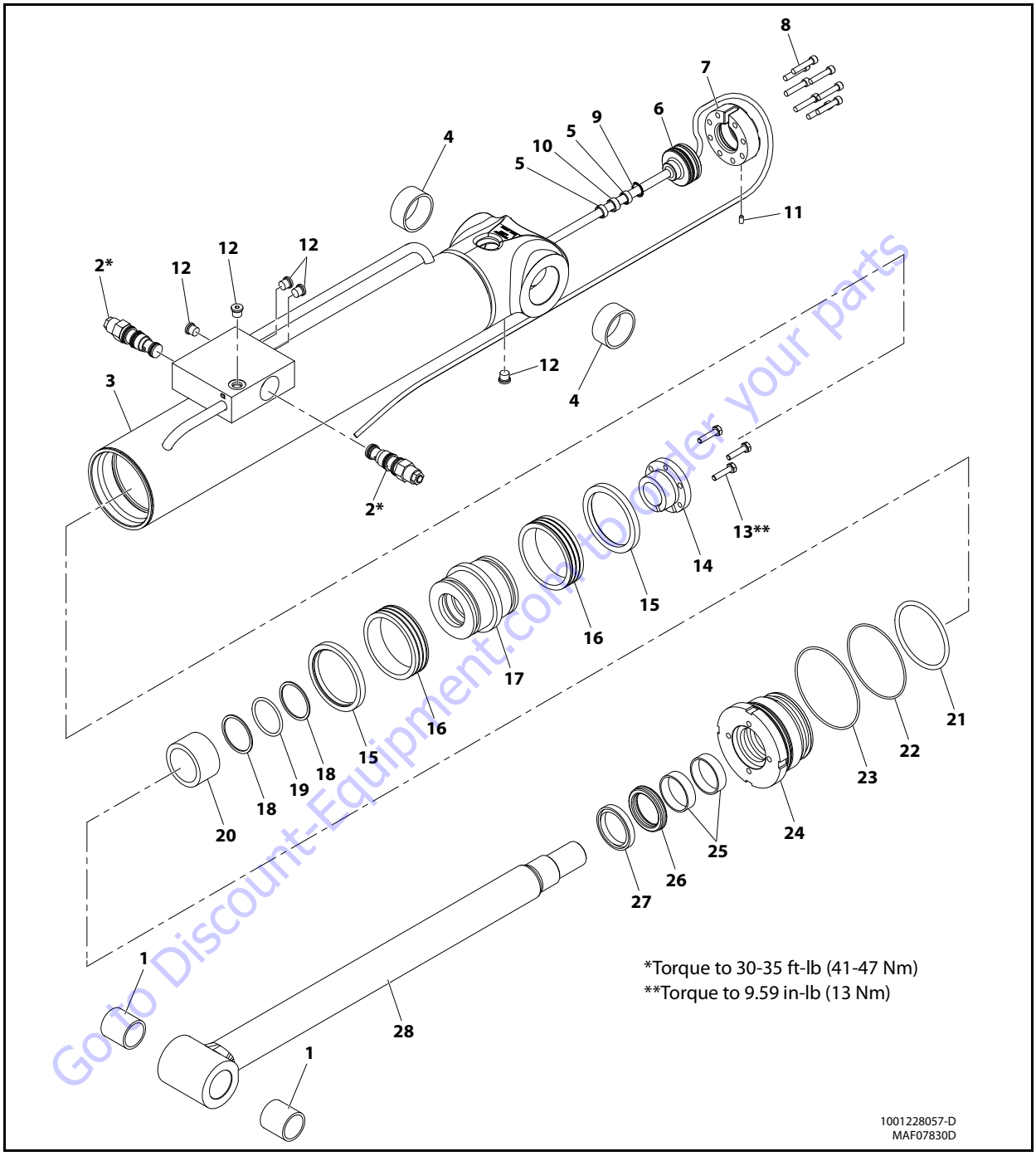


Figure 5-51. Cylinder Head Installation



1. Bushing
2. Counterbalance Valve
3. Barrel
4. Bushing
5. Spacer Sleeve
6. Length Sensor
7. Retainer Cap
8. Capscrew
9. Retaining Ring
10. Sensor Magnet
11. Setscrew
12. Plug
13. Capscrew
14. Tapered Bushing
15. Guidelock Ring
16. Lock Ring
17. Piston
18. Backup Ring
19. O-Ring
20. Spacer
21. Backup Ring
22. O-Ring
23. O-Ring
24. Head
25. Wear Ring
26. Seal
27. Rod Wiper
28. Rod

Figure 5-52. Platform Level Cylinder Assembly

NOTICE

OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

8. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.

9. Protect cylinder rod (28) from damage and clamp in a vise or holding fixture as close to piston (17) as possible.

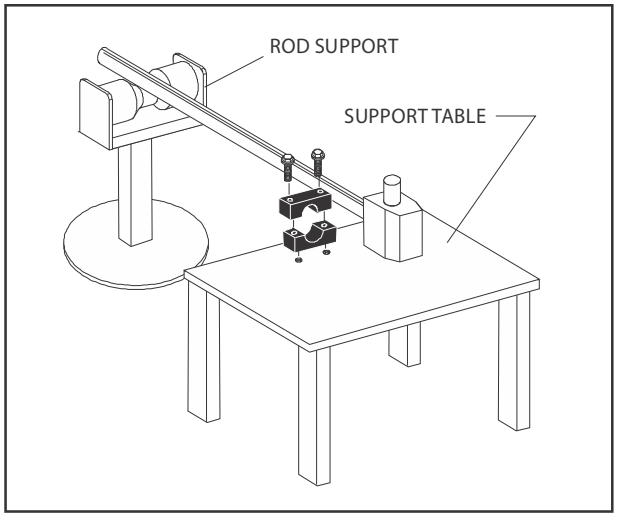


Figure 5-53. Cylinder Rod Support

10. Loosen and remove Capscrews (13) from tapered bushing (14) and piston (17).

11. Insert capscrews (13) in threaded holes in outer piece of tapered bushing (14). Progressively tighten capscrews (13) until tapered bushing (14) is loose. Remove tapered bushing (14) from piston (17).

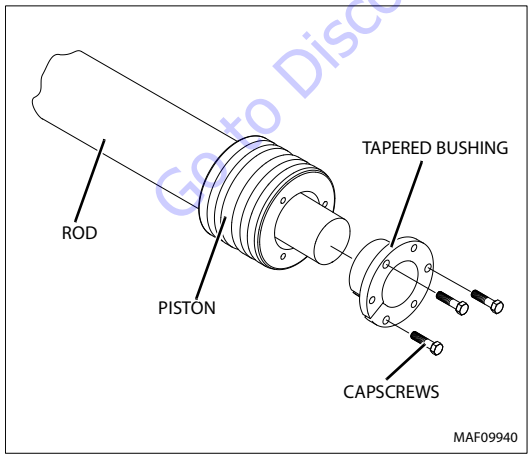


Figure 5-54. Tapered Bushing Removal

12. Screw piston (17) counterclockwise by hand and remove from cylinder rod (28).

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

13. Remove and discard two guidelock ring (15), lock rings (16), backup rings (18), O-ring (19) from piston (17).

14. Remove piston spacer (20) from cylinder rod (28).

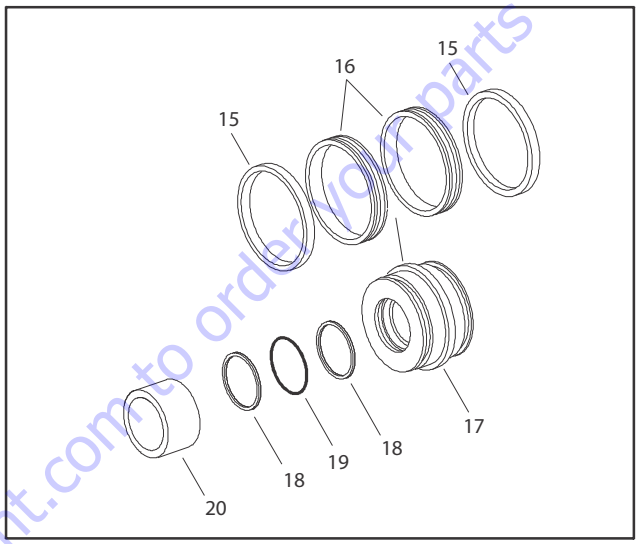


Figure 5-55. Piston Disassembly

15. Remove cylinder rod (28) from holding fixture. Remove cylinder head (24).

16. Remove and discard backup ring (21), O-ring (22), O-ring (23), rod wiper (27), seal (26), and two wear rings (25), from cylinder head (24).

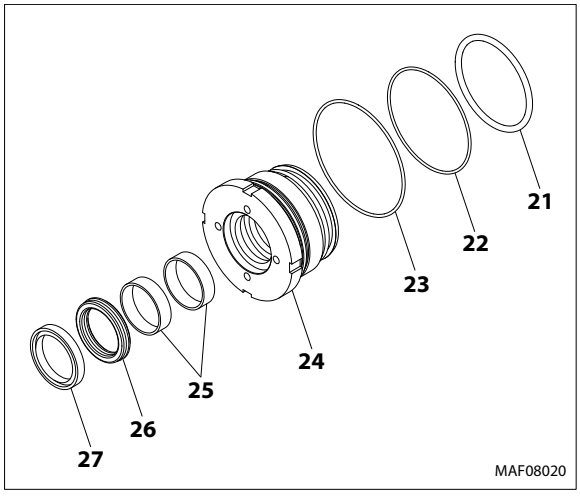


Figure 5-56. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. Inspect cylinder length sensor components for damage. Replace as needed.
14. Inspect rod and barrel bearings for signs of excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of steel bushing with WD40 before installing bushings.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

    d. Press bushing into barrel or rod bushing with correct size arbor.

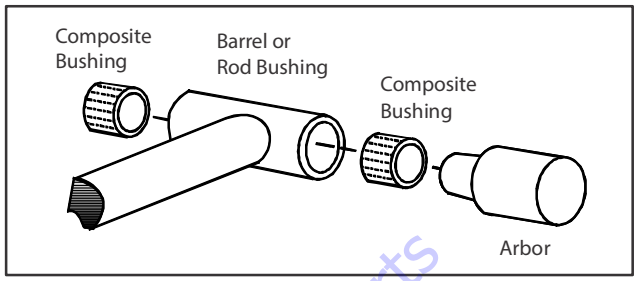


Figure 5-57. Composite Bushing Installation

15. Inspect port block fittings and holding valve. Replace as necessary.
16. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

1. Install O-ring (23), O-ring (22), and backup ring (21) in outside diameter grooves of cylinder head (24).
2. Install two wear rings (25), seal (26), and rod wiper (27), into cylinder head (24).

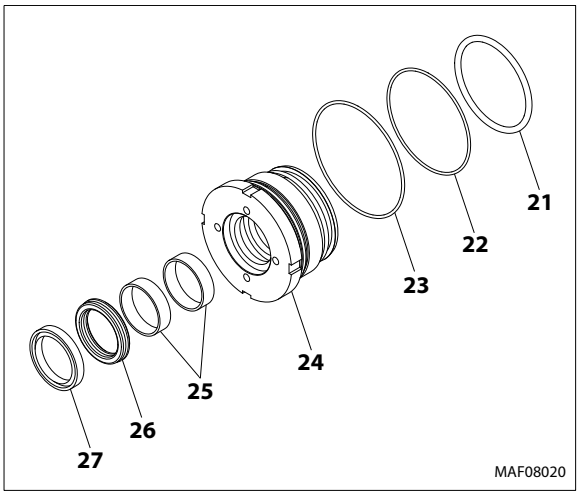


Figure 5-58. Cylinder Head Seal Kit Installation

3. Install cylinder head assembly on rod. Do not damage or dislodge wiper and rod seals. Push head along rod to rod end.
4. Install piston spacer (20) on cylinder rod (28).
5. Install backup rings (18), O-ring (19) in inner diameter grooves of piston (17). Install two guidelock rings (15), lock rings (16) in outer grooves of piston (17).

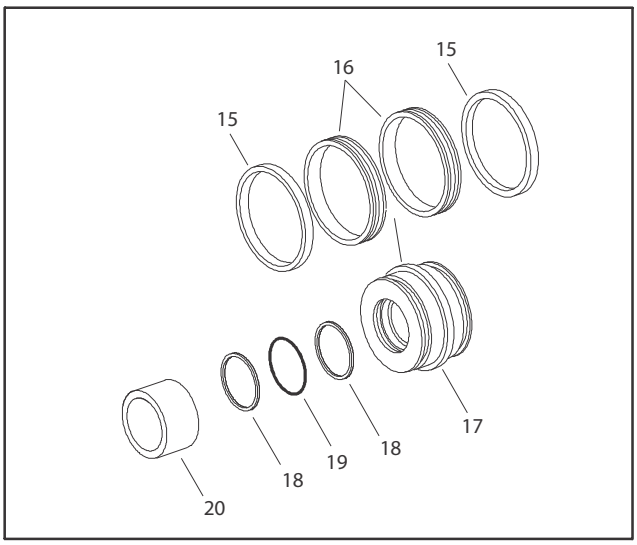


Figure 5-59. Piston Seal Kit Installation

6. Using suitable protection, clamp cylinder rod (28) in a vise or similar holding fixture as close to piston (17) as possible.
7. Thread piston (17) on cylinder rod (28) hand tight. Ensure O-ring and backup rings are not damaged or dislodged.

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

8. Thread piston (17) on cylinder rod (28) until it aligns with spacer (20) end and install tapered bushing (14).
9. Apply Medium strength threadlocking compound or equivalent to tapered bushing capscrews (13) and assemble the tapered bushing (14) loosely into the piston (17. Insert capscrews (13) through the drilled holes in the tapered bushing (14) and into the tapped holes in the piston (17). Insert capscrews (13) through the drilled holes in the tapered bushing (14) and into the tapped holes in the piston (17).

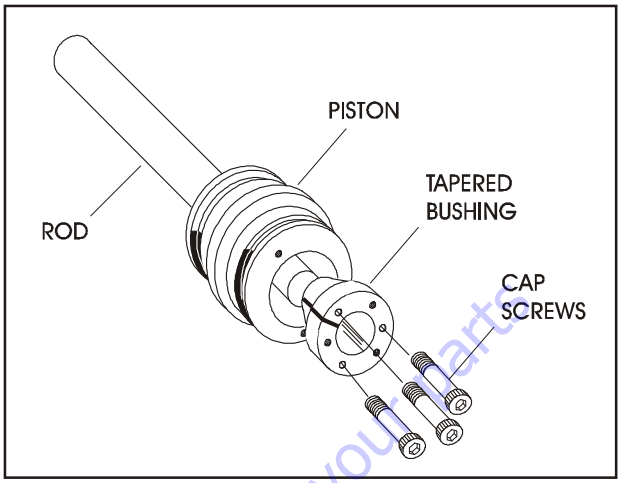


Figure 5-60. Tapered Bushing Installation

10. Tighten the capscrews (13) evenly and progressively in rotation to 9.59 ft. lbs. (13 Nm).
11. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;
    a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.
    b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

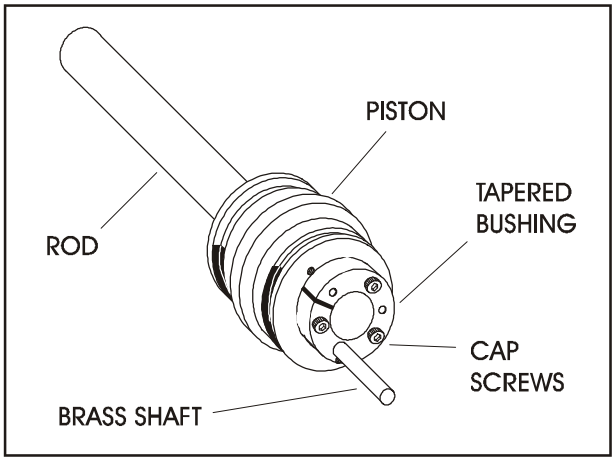


Figure 5-61. Seating the Tapered Bearing

12. Retorque the capscrews evenly and progressively in rotation to 9.59 ft. lbs. (13 Nm).
13. Install two counterbalance valves (2) with new O-rings in valve block. Torque to 30-35 ft-lb (41-47 Nm).
14. If removed, install the cylinder length sensor. See Section 5.4, Cylinder Length Sensor.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

15. Clamp barrel (3) securely and support cylinder rod (28).

NOTE: *Apply locking primer and Medium strength threadlocking compound. to cylinder head threads.*

16. Insert piston (17) end into cylinder barrel (3). Do not damage or dislodge piston loading O-ring and seal ring.

17. Continue pushing cylinder rod (28) into cylinder barrel (3) until cylinder head (24) gland can be inserted into cylinder barrel (3).

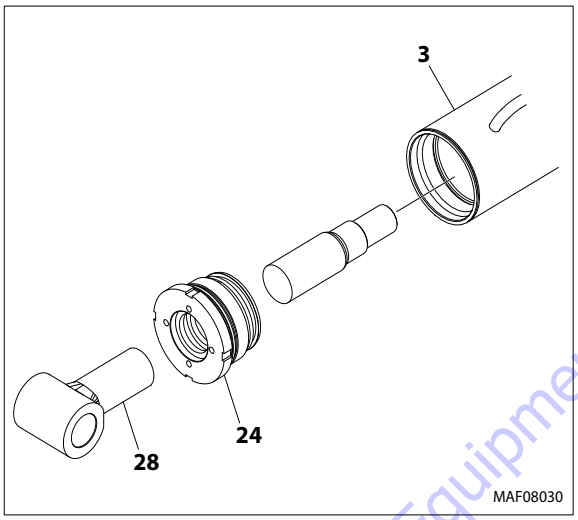


Figure 5-62. Rod and Cylinder Head Installation

18. Tighten cylinder head with hook spanner wrench. Torque cylinder head to 180-220 ft. lbs. (244-298 Nm).

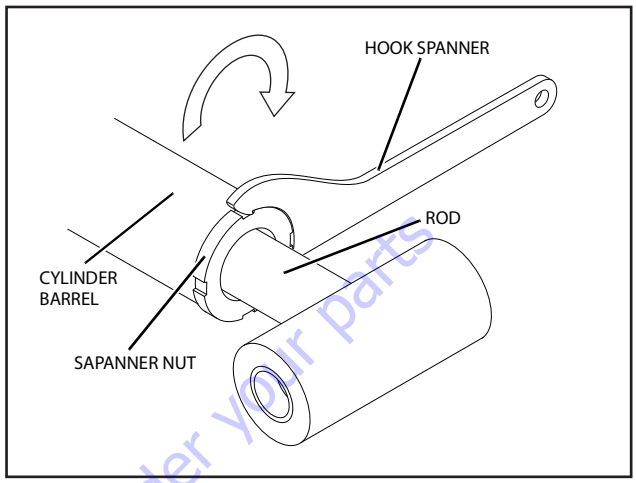


Figure 5-63. Cylinder Head Tightening

19. Install the plugs (12) in the cylinder ports.

Boom Lift Cylinder

Refer to Figure 5-67.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.
3. If applicable, remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.
4. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

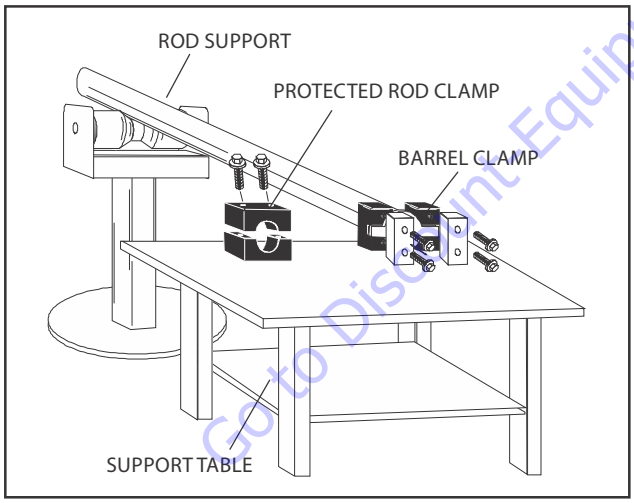


Figure 5-64. Cylinder Barrel Support

5. Mark cylinder head and barrel with center punch marks for later realignment. Remove cylinder head capscrews.

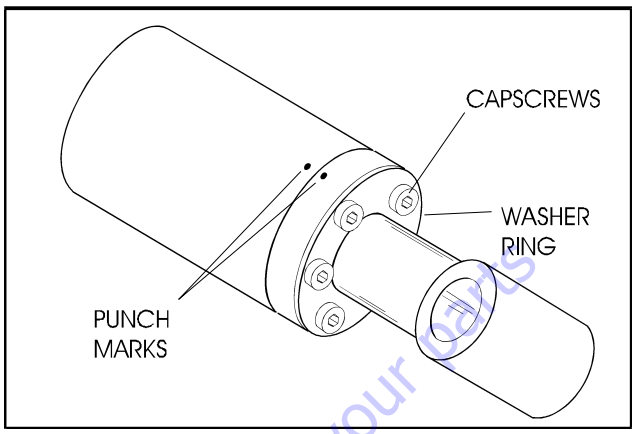


Figure 5-65. Capscrew Removal

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

6. Clamp barrel securely. Unscrew cylinder head and pull rod assembly from barrel.
7. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

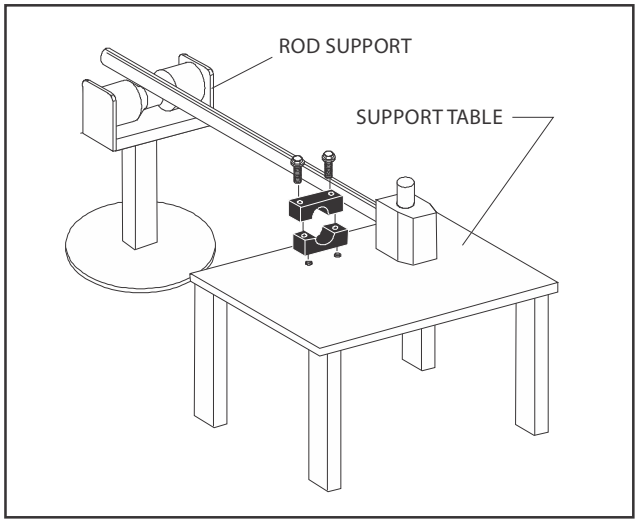
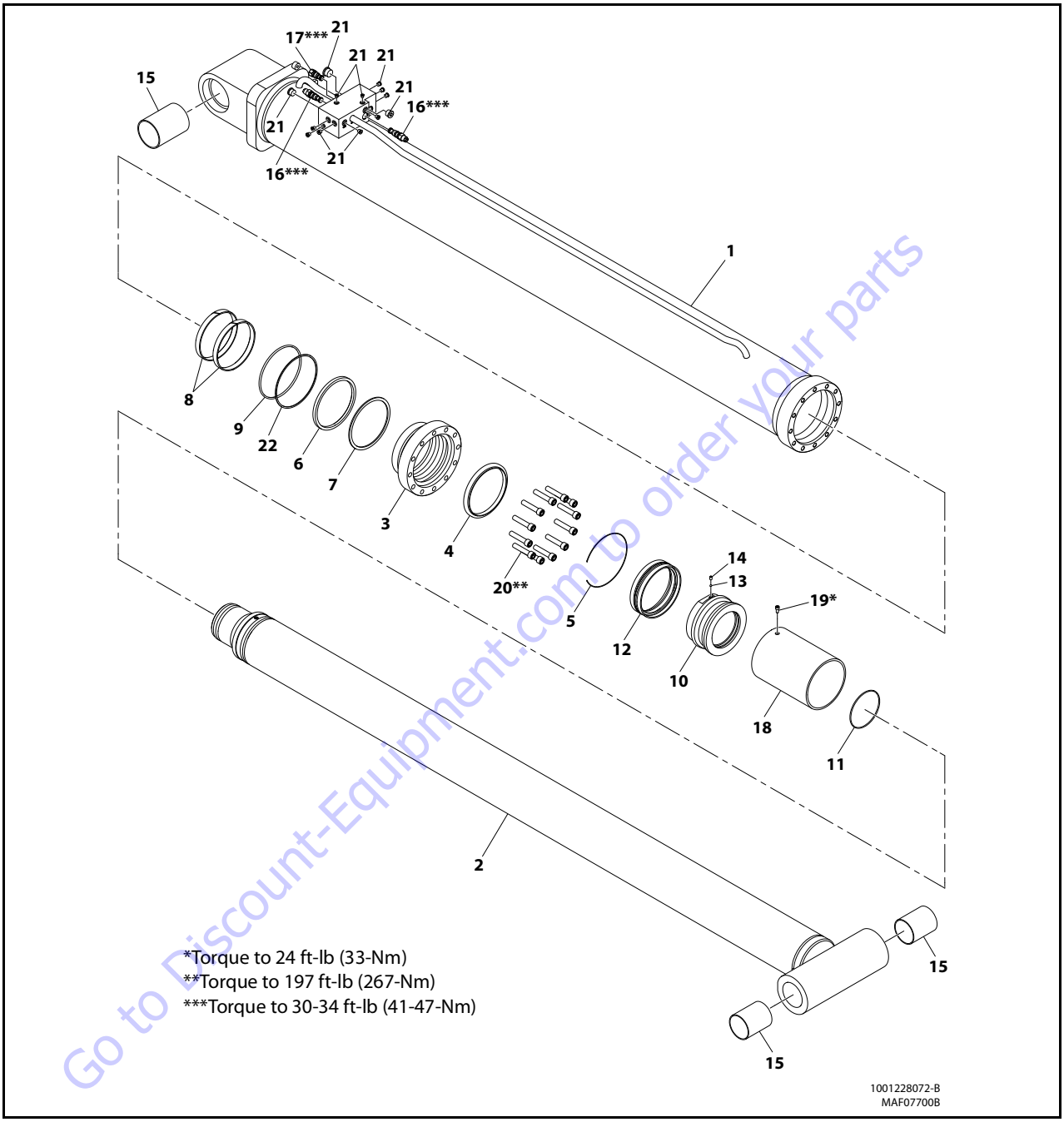


Figure 5-66. Cylinder Rod Support



1. Barrel
2. Rod
3. Head
4. Wiper Seal
5. Retainer Ring
6. Rod Seal
7. Backup Ring
8. Wear Ring
9. O-Ring
10. Piston
11. Rod, O-Ring
12. Piston Seal
13. Stell Ball
14. Setscrew
15. Bushing
16. Counterbalance Valve
17. Shuttle Valve
18. Spacer
19. Capscrew
20. Capscrew
21. Plug
22. Backup Ring

Figure 5-67. Boom Lift Cylinder Assembly

8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Remove setscrews attaching piston to cylinder rod.
10. Screw the piston counterclockwise by hand and remove piston from cylinder rod.

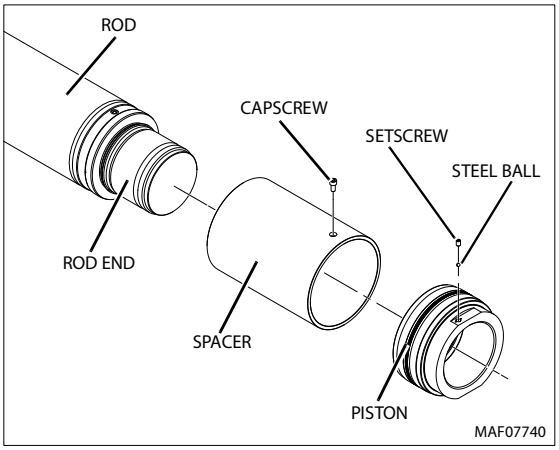


Figure 5-68. Piston Removal

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

11. Remove and discard piston seal (12) from outside grooves of piston (10).
12. Remove spacer (18) from rod (2). Remove and discard O-ring (11).

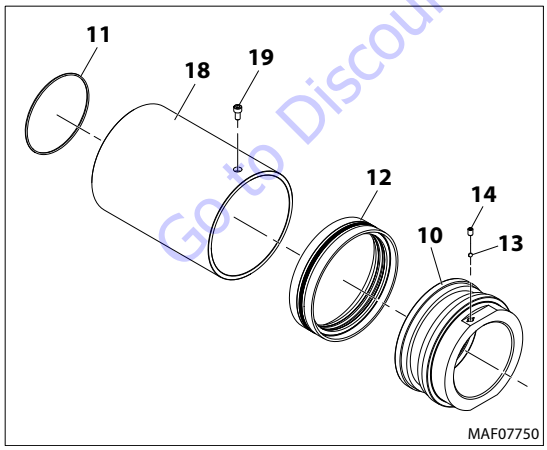


Figure 5-69. Piston Disassembly

13. Remove rod (2) from holding fixture. Remove cylinder head (3) from rod (2).
14. Remove and discard wear rings (8), wiper seal (4), retaining ring (5), rod seal (6), backup ring (7) from inside of cylinder head (3).

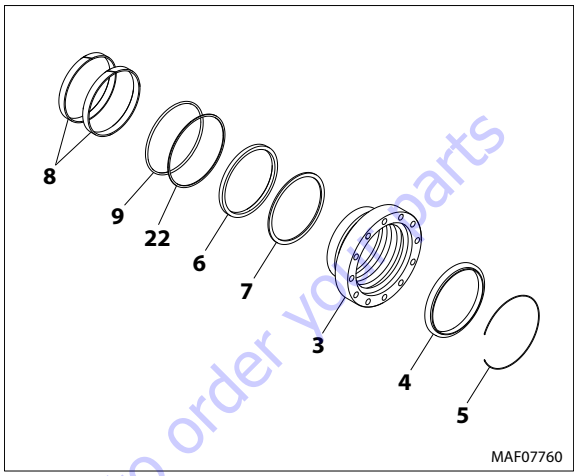


Figure 5-70. Cylinder Head Disassembly

15. Remove and discard O-ring (9) and backup ring (22) from outside grooves of cylinder head (3).

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.

11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.

12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.

13. Inspect rod and barrel bearings for signs of correct excessive wear or damage. Replace as necessary.

a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.

b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.

c. Lubricate inside of the steel bushing with WD40 prior to bearing installation.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

d. Press bushing into barrel or rod bushing with correct size arbor.

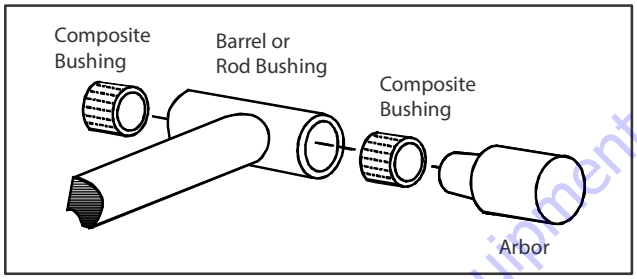


Figure 5-71. Bushing Installation

14. Inspect port block fittings and holding valves. Replace as necessary.

15. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

1. Install wear rings (8), wiper seal (4), retaining ring (5), rod seal (6), backup ring (7) in inside grooves of cylinder head (3).

2. Install O-ring (9) and backup ring (22) in outside grooves of cylinder head (3).

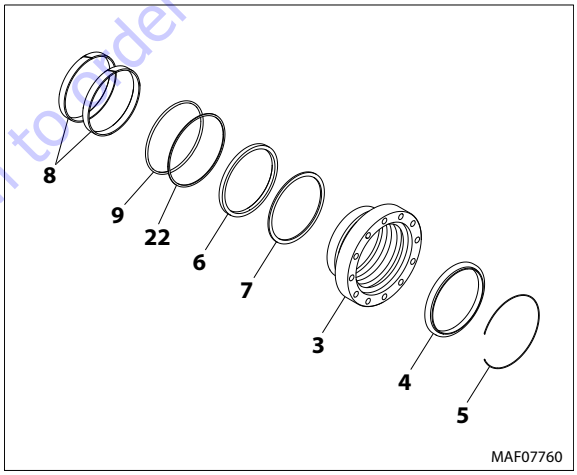


Figure 5-72. Cylinder Head Assembly

3. Carefully install cylinder head assembly (3) on rod (2). Do not damage or dislodge wiper and rod seals. Push head along rod to rod end.

4. Install O-ring (11) into the spacer (18) and Carefully slide spacer (18) onto rod (2) with O-ring (11) end facing cylinder head. Ensure that O-ring not damage and dislodge.

5. Install piston seal (12) in outside grooves of piston (10).
6. Using suitable protection, clamp cylinder rod (2) in a vise or similar holding fixture as close to piston as possible.

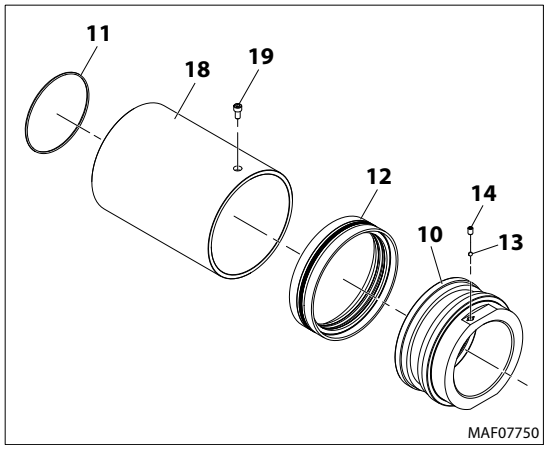


Figure 5-73. Piston Assembly

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

7. Carefully thread piston (10) on cylinder rod (2) hand tight. Do not damaged or dislodge O-ring and backup rings.
8. Install the setscrew (14) and stell ball (13) on the piston (10) and attach the piston (10) on the rod (2).
9. Position cylinder barrel (1) in a suitable holding fixture.

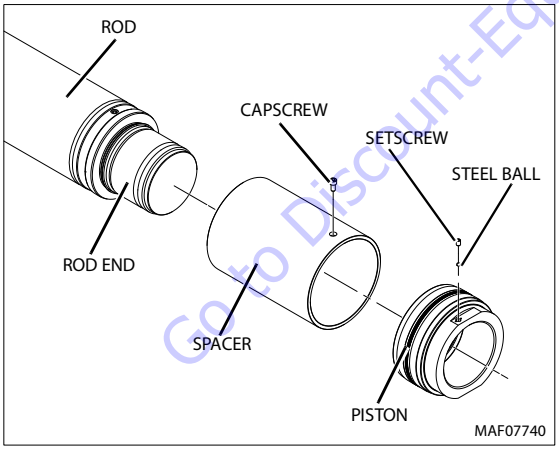


Figure 5-74. Piston Removal

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

10. Clamp barrel (1) securely and support rod (2). Insert piston (10) end in barrel. Do not damage or dislodge piston O-rings or seal rings.
11. Continue pushing rod in barrel until cylinder head (3) can be inserted in barrel.
12. Install cylinder head (3) until tight and marks made during disassembly are aligned.
13. Secure cylinder head assembly (3) to barrel (1) with capscrews (20). Torque to 197 ft-lb (267-Nm).

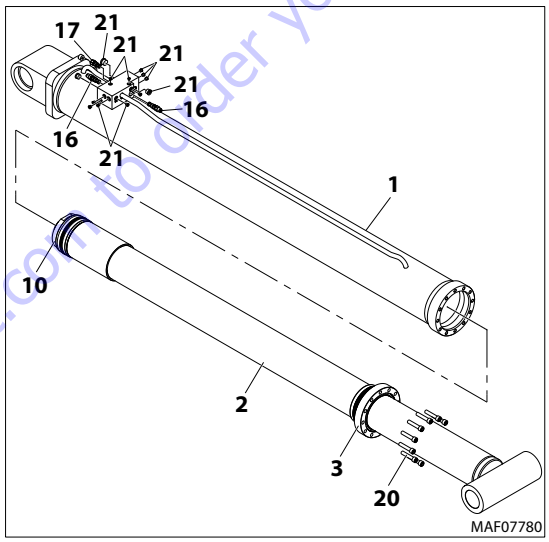


Figure 5-75. Rod Assembly Installation

14. Install the plugs (21) in the cylinder ports.
15. Install two counterbalance valves (16) in valve block. Torque to 30-34 ft-lb (41-47-Nm).
16. Install shuttle valves (17) valve block. Torque to 30-34 ft-lb (41-47-Nm).

Jib Lift Cylinder

Refer to Figure 5-79.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod, if applicable.

3. Place cylinder barrel in a suitable holding fixture.

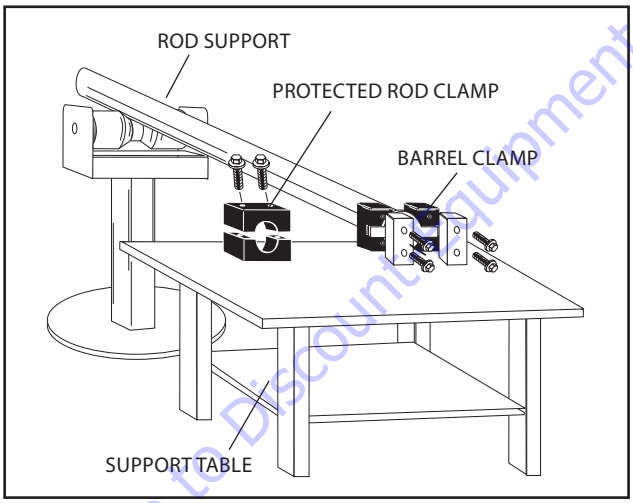


Figure 5-76. Cylinder Barrel Support

4. Remove cartridge-type counterbalance valve and fittings from cylinder port block. Discard O-rings.

5. If necessary, remove eight capscrews (11) and retainer cap (10). Remove O-Ring plug (5) and setscrew (4). Remove cylinder length sensor assembly (9) from barrel (1).

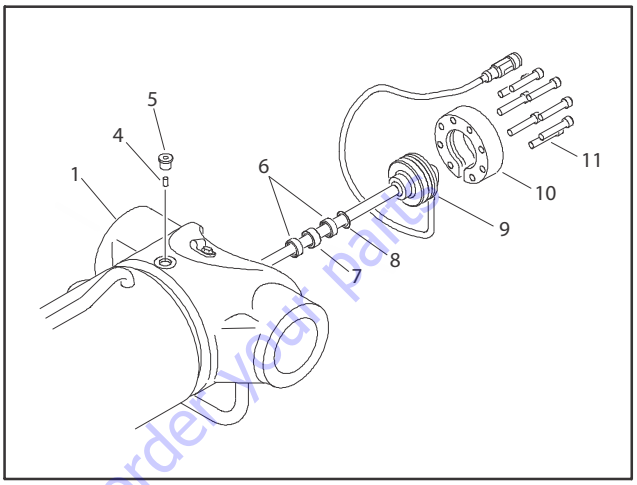


Figure 5-77. Cylinder Length Sensor Removal

6. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

7. Mark cylinder head and barrel with center punch marks for later realignment. Remove eight cylinder head capscrews.

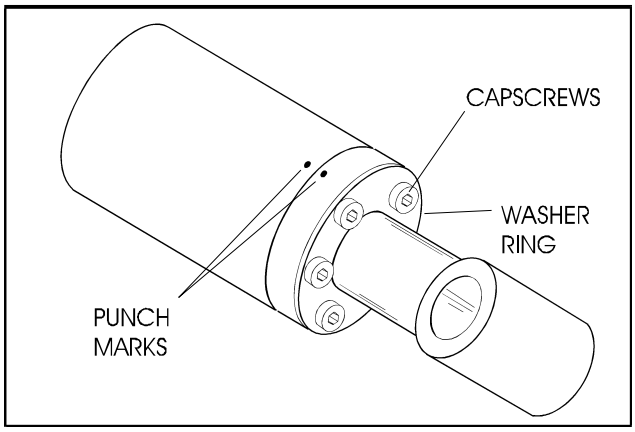
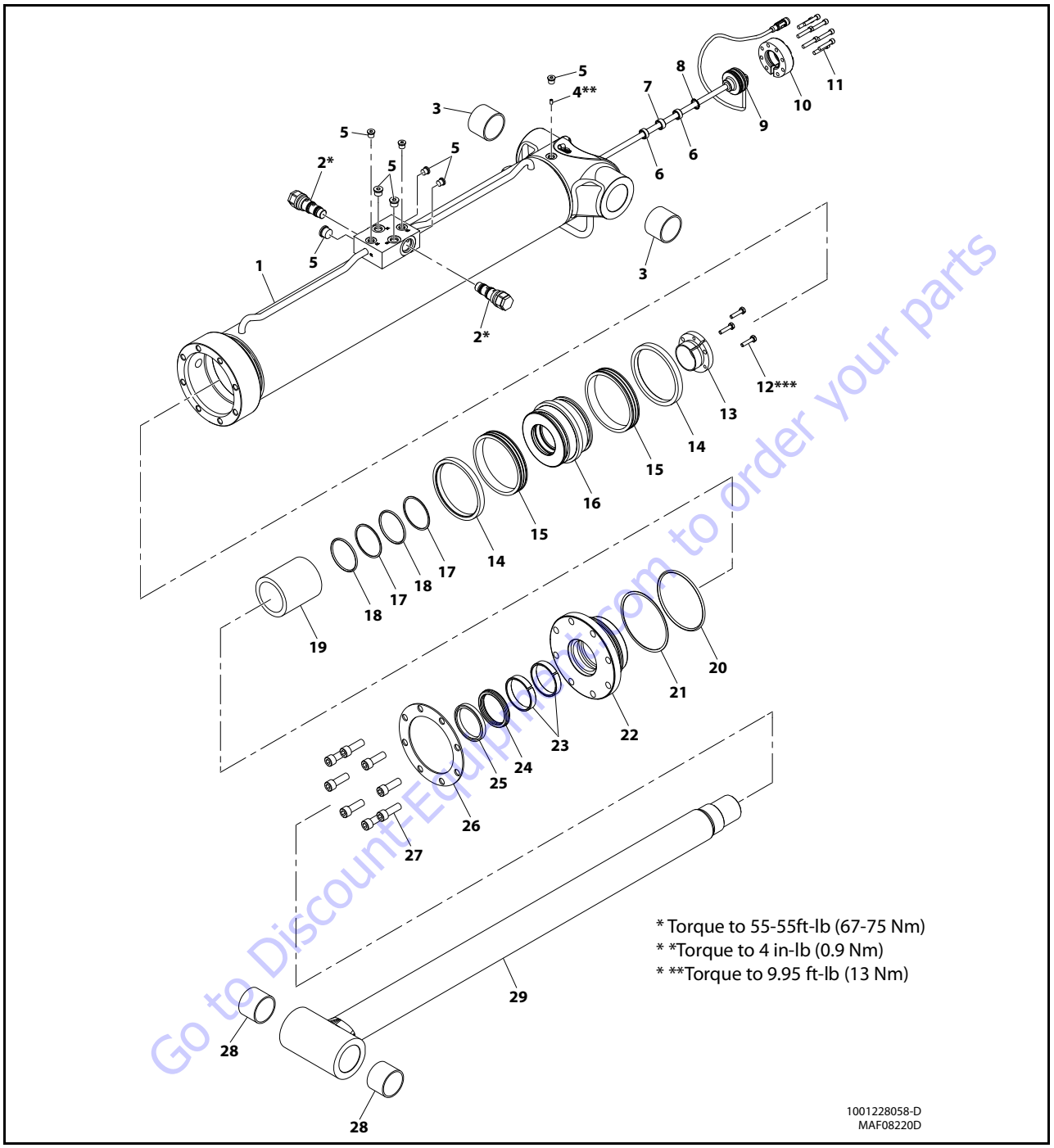


Figure 5-78. Capscrew Removal



1. Barrel
2. Counterbalance Valve
3. Bushing
4. Setscrew
5. O-Ring Plug
6. Spacer
7. Sensor Magnet
8. Internal Retaining Ring
9. Cylinder Length Sensor
10. Retainer Cap
11. Capscrew
12. Capscrew
13. Tapered Bushing
14. Lock Ring
15. Seal
16. Piston
17. Backup Ring
18. O-Ring
19. Spacer
20. O-Ring
21. Backup Ring
22. Cylinder Head
23. Wear Ring
24. Seal
25. Rod Wiper
26. Washer Ring
27. Capscrew
28. Bushing
29. Rod

Figure 5-79. Jib Lift Cylinder Assembly

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

8. Clamp barrel (1) securely. Pull rod assembly and cylinder head from barrel.

9. Protect cylinder rod (29) from damage and clamp in a vise or holding fixture as close to piston (16) as possible.

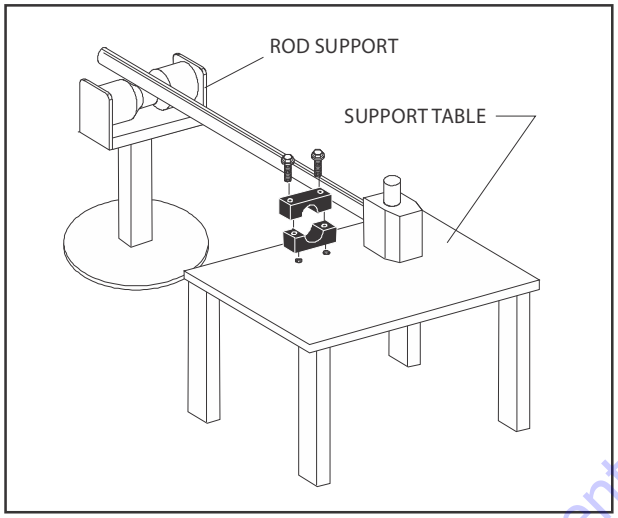


Figure 5-80. Cylinder Rod Support

10. Loosen and remove Capscrews (12) from tapered bushing (13) and piston (16).

11. Insert Capscrews (12) in threaded holes in outer piece of tapered bushing (13). Progressively tighten bolts until bushing is loose. Remove tapered bushing (13) from piston (16).

12. Screw piston(16) counterclockwise by hand and remove from cylinder rod (29).

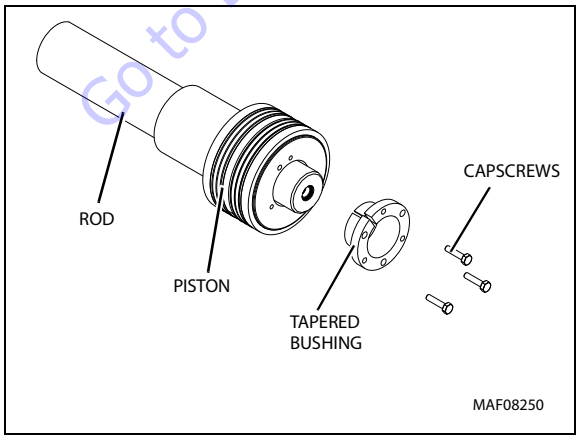


Figure 5-81. Tapered Bushing Removal

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

1. Remove and discard two lock rings (14), seals (15), backup ring (17), O-ring (18), and backup ring (17) from piston (16).

2. Remove piston spacer (19) from rod (29). Remove and discard O-ring (18) from inside of spacer.

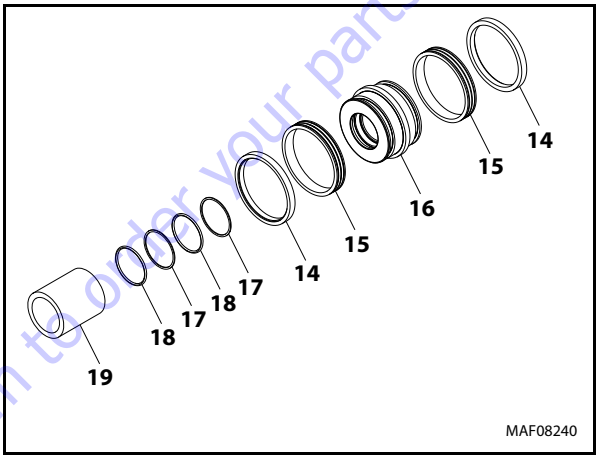


Figure 5-82. Piston Disassembly

3. Remove rod from holding fixture. Remove cylinder head (22) and washer ring (26).

4. Remove and discard O-ring (20), backup ring (21), rod wiper (25), seal (24) and two wear rings (23) from cylinder head (22).

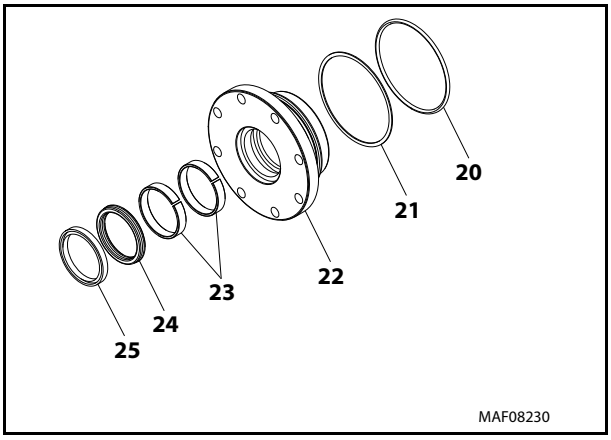


Figure 5-83. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. Inspect cylinder length sensor components for damage. Replace as needed.
14. Inspect rod and barrel bearings for signs of excessive wear or damage. Replace as necessary.
    a. Thoroughly clean hole, (steel bushing) of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of steel bushing with WD40 before installing bushings.

NOTE: *Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushing dry.*

    d. Press bushing into barrel or rod bushing with correct size arbor.

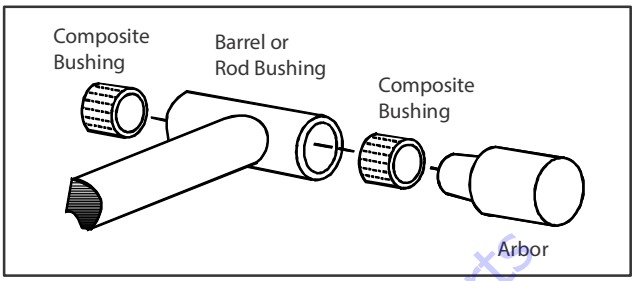


Figure 5-84. Composite Bushing Installation

15. Inspect port block fittings and holding valve. Replace as necessary.
16. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*
Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

1. Install backup ring (21) and O-ring (20) in outside diameter grooves of cylinder head (22).
2. Install two wear rings (23) seal (24) and rod wiper (25) in cylinder head as shown.

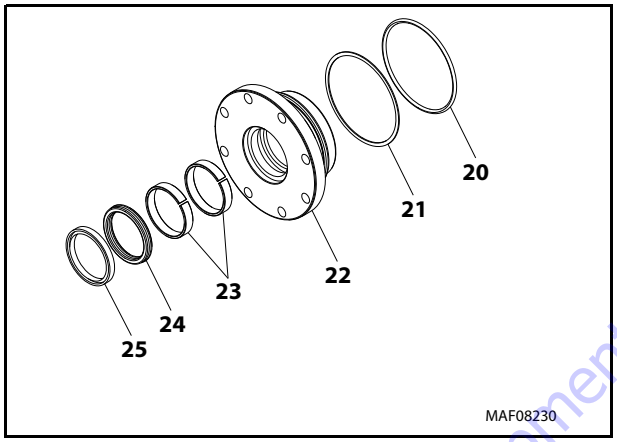


Figure 5-85. Cylinder Head Seal Kit Installation

3. Install washer ring (26) on rod (29). Install cylinder head assembly on rod. Do not damage or dislodge wiper and rod seals. Push head along rod to rod end.
4. Install O-ring (18) in spacer (19). Slide piston spacer on rod (29).
5. Install backup ring (17), O-ring (18) and backup ring (17) in inner diameter grooves of piston (16). Install two seals (15) and lock rings (14) in outer grooves of piston.

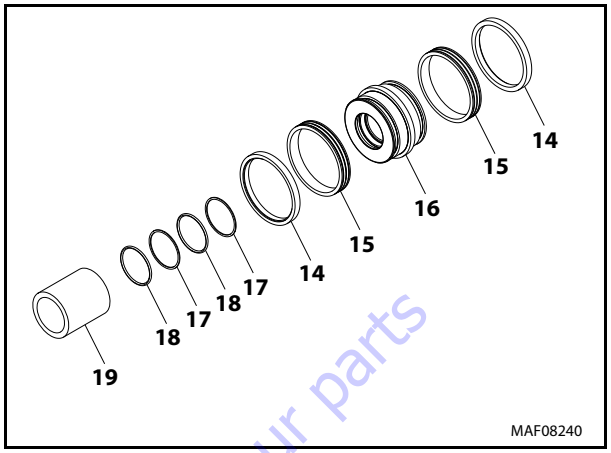


Figure 5-86. Piston Seal Kit Installation

6. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston (16) as possible.
7. Thread piston (16) on cylinder rod (29) hand tight. Ensure O-ring and backup rings are not damaged or dislodged.

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

8. Thread piston on rod until it aligns with spacer end and install tapered bushing.

NOTE: *When installing the tapered bushing, piston and mating end of rod must be free of oil.*

9. Apply Medium strength threadlocking compound to tapered capscrews (12). Assemble the tapered bushing (13) loosely into the piston (16) and insert capscrews through the drilled holes in the bushing and into the tapped holes in the piston (16).

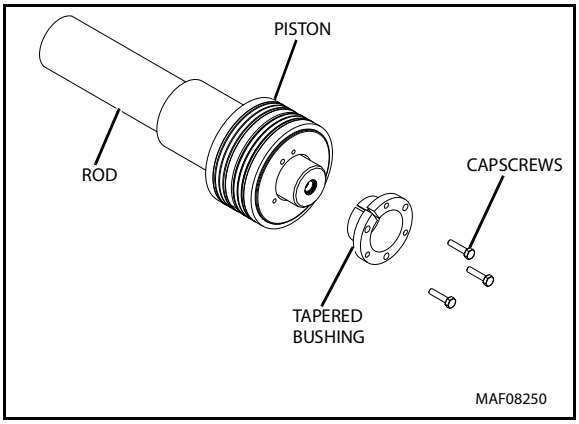


Figure 5-87. Tapered Bushing Installation

1. Tighten the capscrews (12) evenly and progressively in rotation to 9.59 ft.lbs (13 Nm).

2. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;
   a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.
   b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

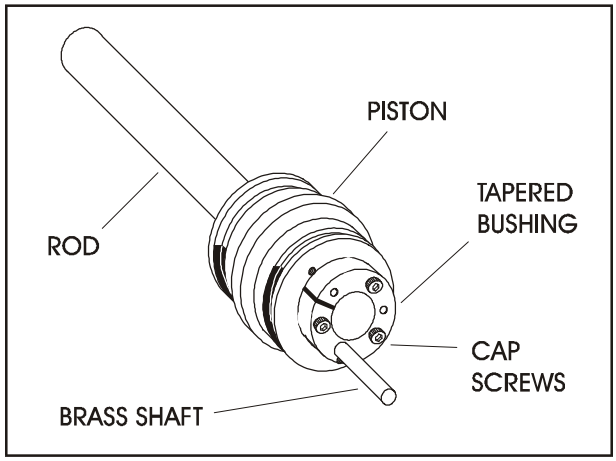


Figure 5-88. Seating the Tapered Bearing

3. Retorque the capscrews (12) evenly and progressively in rotation to 9.59 ft.lbs (13 Nm).

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

4. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston loading O-ring and seal ring.
5. Continue pushing cylinder rod (29) into barrel (1) until cylinder head (23) gland can be inserted into cylinder barrel (1).

NOTE: *Apply Medium strength threadlocking compound or equivalent to capscrews*

6. Secure cylinder head (22) and washer ring (26) with eight capscrews (27).

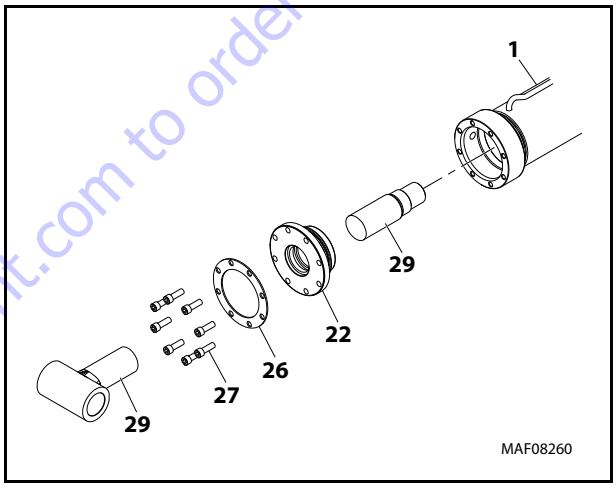


Figure 5-89. Rod Assembly Installation

7. Install two counterbalance valves (2) with new O-rings in valve block. Torque to 50-55 ft-lb (67-75 Nm).
8. If removed, install the cylinder length sensor. See Section 5.4, Cylinder Length Sensor.

Jib Lock Cylinder

Refer to Figure 5-91.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source.
3. Place cylinder barrel in a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.
4. Mark cylinder head and barrel with a center punch for realignment. Unscrew cylinder head with pin-face spanner wrench.

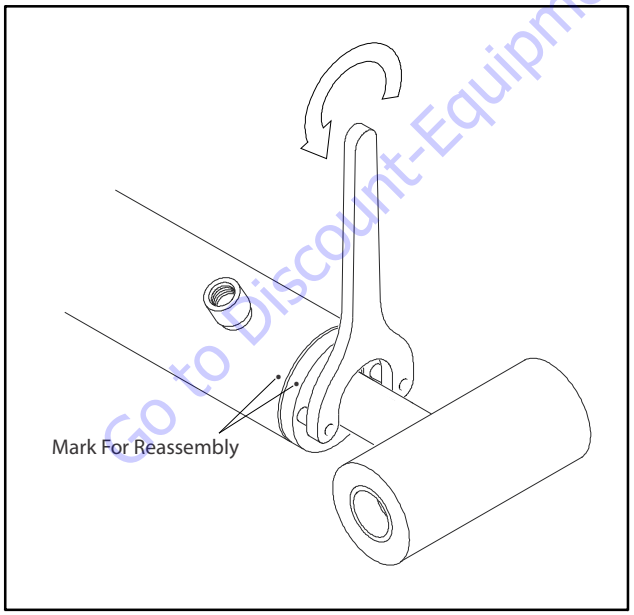


Figure 5-90. Cylinder Head Removal

NOTICE

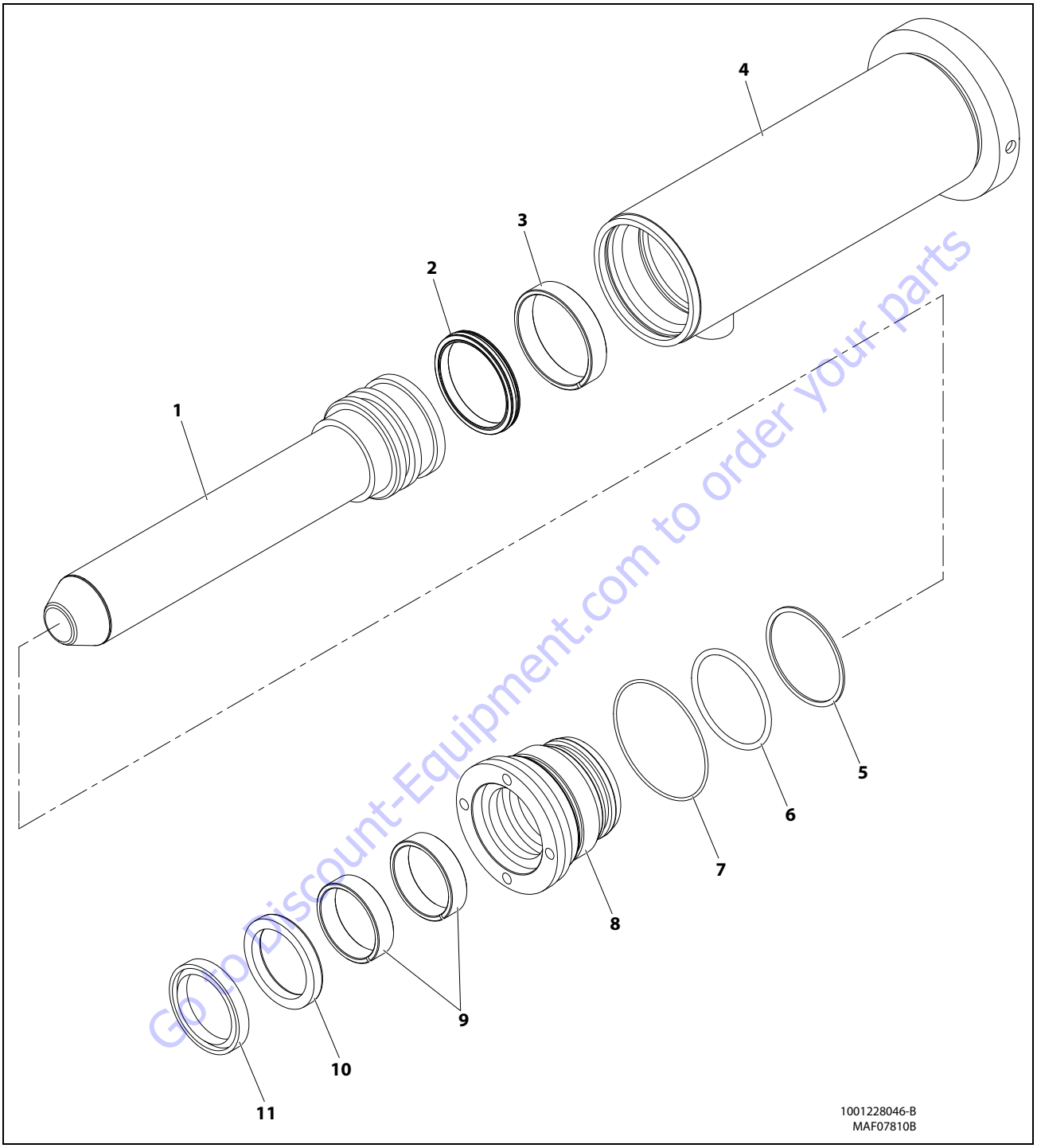
PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

5. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
6. Protect cylinder rod from damage and clamp in a vise or holding fixture.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

7. Remove and discard seal (2) and wear ring (3) from rod (1).
8. Remove and discard rod wiper (11), seal (10), and two wear rings (9) from inside of cylinder head (8).
9. Remove and discard O-ring (5), backup ring (6), and O-ring (7) from outer groves of cylinder head.



1. Rod
2. Seal
3. Wear Ring
4. Barrel
5. O-Ring
6. Backup Ring
7. O-Ring
8. Head
9. Wear Ring
10. Seal
11. Rod Wiper

Figure 5-91. Jib Lock Cylinder Assembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect inner surface of barrel for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
4. Inspect threaded portion of barrel for damage. Dress threads as necessary.
5. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
6. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
7. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
8. Inspect threaded portion of head for damage. Dress threads as necessary.
9. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
10. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
11. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

1. Position cylinder barrel in a suitable holding fixture.
2. Use seal tool to install new rod seal into applicable cylinder head gland groove.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

3. Install O-ring (7), backup ring (6), and O-ring (5) in applicable outside diameter groove of cylinder head (8).
3. Install two wear rings (9), seal (10), and rod wiper (11) to inside grooves of cylinder head.
4. Install seal (2) and wear ring (3) to piston end of rod (1).

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

NOTE: *Apply anti-seize compound to cylinder head threads.*

5. Insert piston end into barrel cylinder. Do not damage or dislodge piston loading O-ring and seal ring. Push rod in barrel as far as possible without excess force.
6. Slide cylinder head assembly (8) over rod and screw into barrel. Tighten cylinder head with pin spanner wrench.

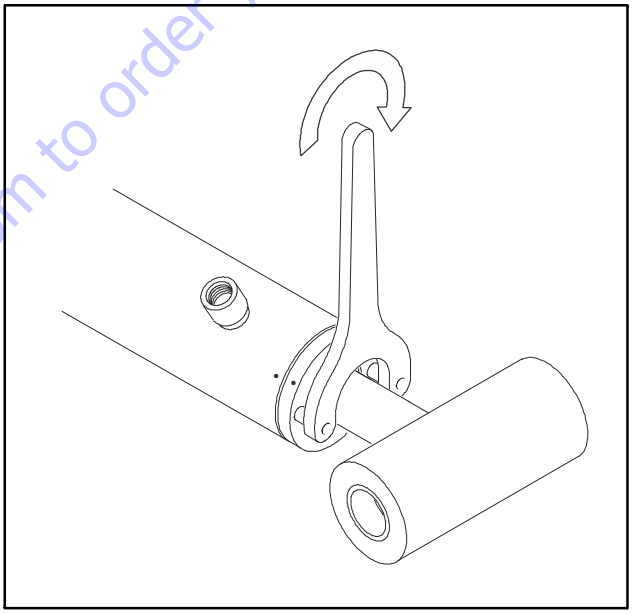


Figure 5-92. Cylinder Head Installation

Steer Cylinder

Refer to Figure 5-95.

DISASSEMBLY

NOTICE

CCONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source.
3. Place cylinder barrel in a suitable holding fixture.
4. Mark cylinder head and barrel with center punch marks for later realignment.
5. Unscrew cylinder head with hook spanner wrench.

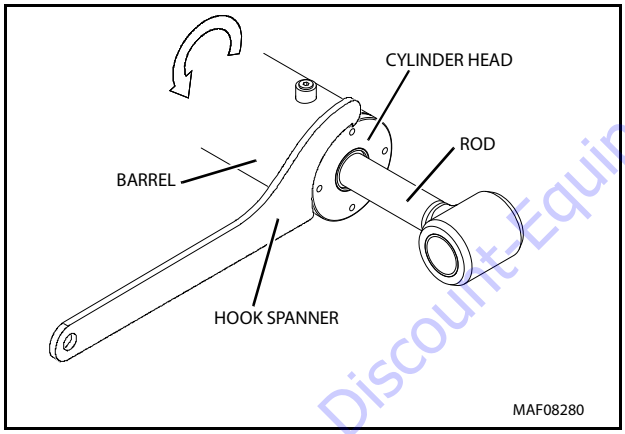


Figure 5-93. Cylinder Head Removal

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

6. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
7. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

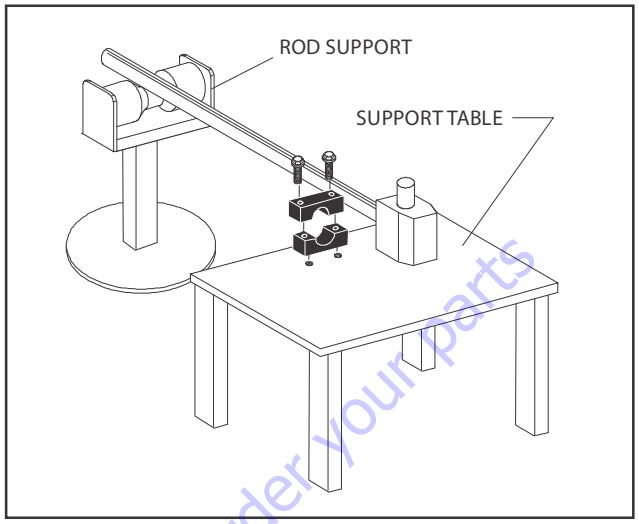
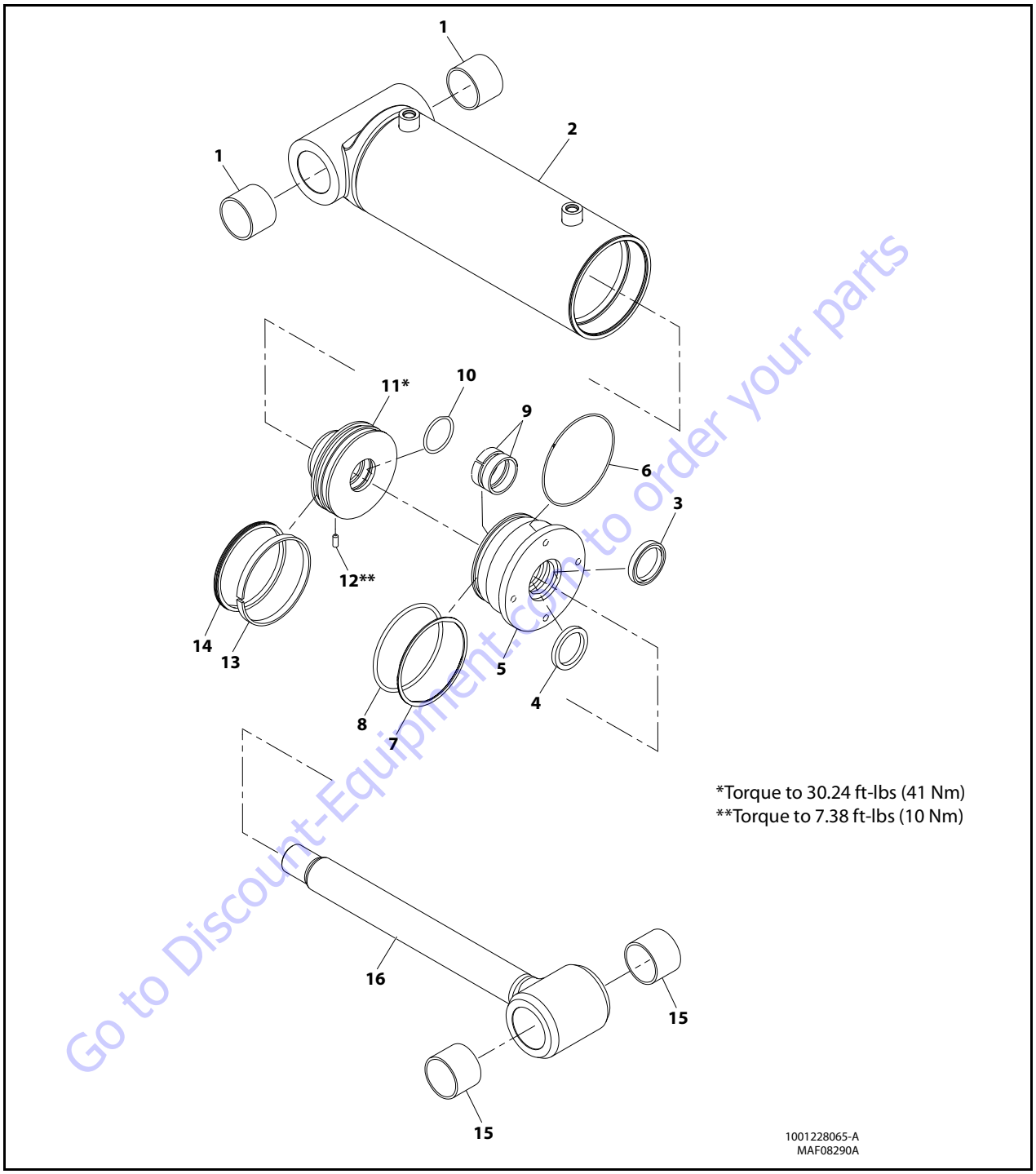


Figure 5-94. Cylinder Rod Support

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

8. Remove setscrew (13) from piston (12). remove piston (12) from Cylinder rod (16).
9. Remove and discard O-ring (11), seal (15), and wear ring (14) from piston (12). Remove cylinder rod (16) from clamp or vise.



1. Bushing
2. Barrel
3. Wiper Seal
4. Seal
5. Head
6. O-Ring
7. Backup Ring
8. O-Ring
9. Wear Ring
10. O-Ring
11. Piston
12. Setscrew
13. Wear Ring
14. Seal
15. Bushing
16. Rod

Figure 5-95. Steer Cylinder Assembly

10. Remove cylinder head assembly (5) from rod (16).

10. Remove and discard two wear rings (9), seal (4), wiper seal (3), O-ring (8), backup ring (7), and O-ring (6) from cylinder head (5).

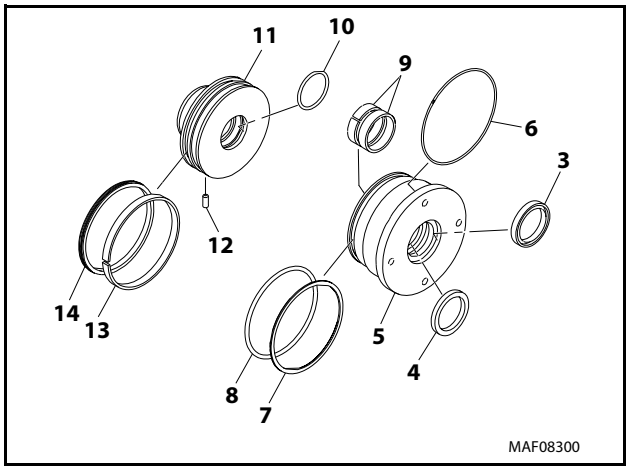


Figure 5-96. Piston and Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
13. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE 'POLY-PAK' PISTON SEALS ARE PROPERLY INSTALLED. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION.

1. Install two wear rings (9) in cylinder head (5).
2. Install two wear rings (10) in cylinder head.
3. Install O-Ring (6), backup ring (7), and O-ring (8) to outside grooves of cylinder head (5).
4. Slide cylinder head assembly (5) on cylinder rod (16).
5. Install O-ring (10) to inside groove of piston (11).
6. Install wear ring (13) and seal (14) in outside grooves of piston (11).
7. Using suitable protection, clamp cylinder rod (16) in a vise or similar holding fixture as close to piston (5) as possible.
8. Apply medium-high strength (red) thread-locking compound or equivalent to rod threads.
9. Thread piston (5) assembly on cylinder rod (16). Do not dislodge or damage O-ring. Torque piston to 30.24 ft-lbs (41 Nm).
10. Install setscrew (12) in piston. Torque to 7.38 ft-lbs (10 Nm).

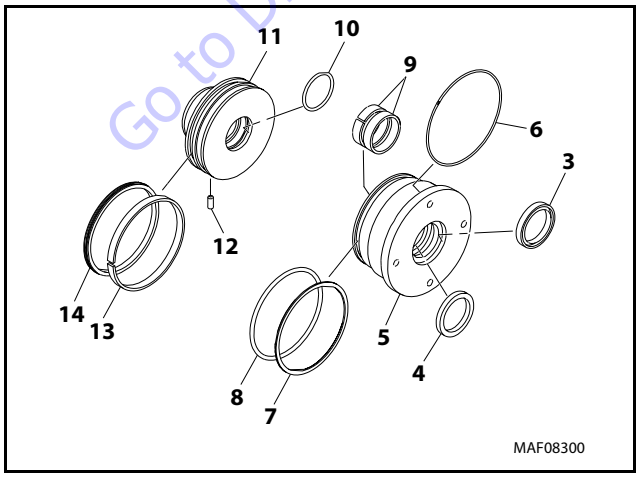


Figure 5-97. Cylinder Head and Piston Assembly

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

11. Clamp barrel (2) securely in suitable fixture and support rod. Insert piston (5) end into barrel cylinder. Do not damage or dislodge piston O-rings or seal rings.
12. Apply ant-seize compound to cylinder head threads.
13. Continue pushing rod into barrel until cylinder head can be inserted into barrel cylinder.
14. Screw in cylinder head (5) to barrel (2).
15. Adjust cylinder head until Mark up of Center Punch hole aligns with barrel.

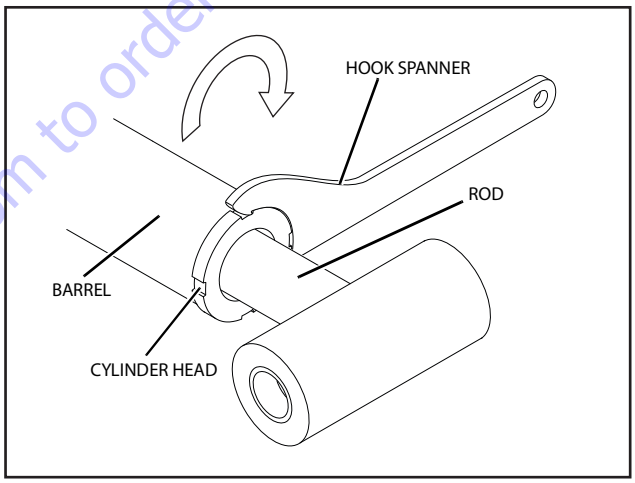


Figure 5-98. Cylinder Head Installation

Jib Telescope Cylinder

Refer to Figure 5-101.

DISASSEMBLY

NOTICE

CCONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source.
3. Place cylinder barrel in a suitable holding fixture. Clean outside of cylinder to prevent contamination.
4. Remove two bolts (3), four washers (4), two nuts (9) and wear pad (5) from bracket (7). Repeat for remaining wear pad.
5. Remove eight socket head screws (6) and two pad supports (7) from cylinder head (12). Reinstall one socket head screw finger-tight.
6. Remove three cartridge valves from valve block.
7. Tap around outside of cylinder head retainer with a suitable hammer to break thread-locking compound.

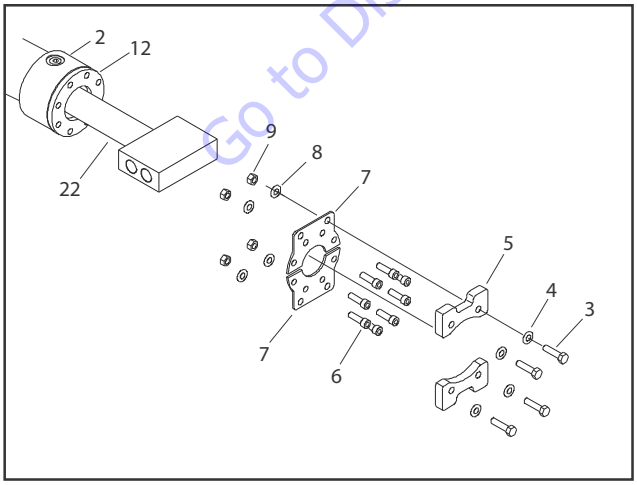


Figure 5-99. Cylinder Head and Wear Pads

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

8. Clamp barrel securely. Pull rod assembly out until piston bottoms to cylinder head.
9. Remove capscrew and pull rod assembly and cylinder head from barrel.
10. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

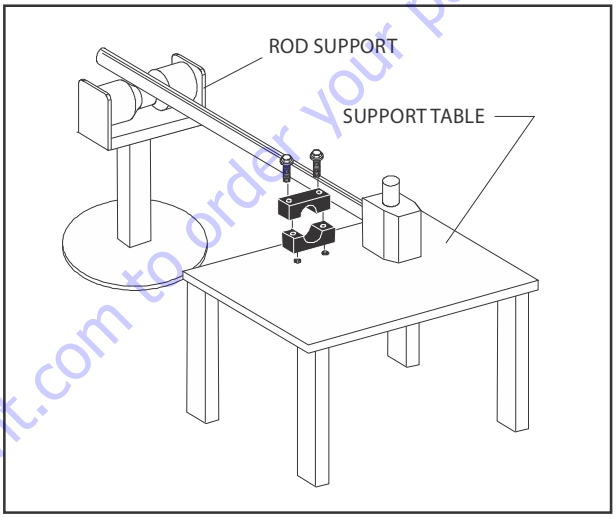
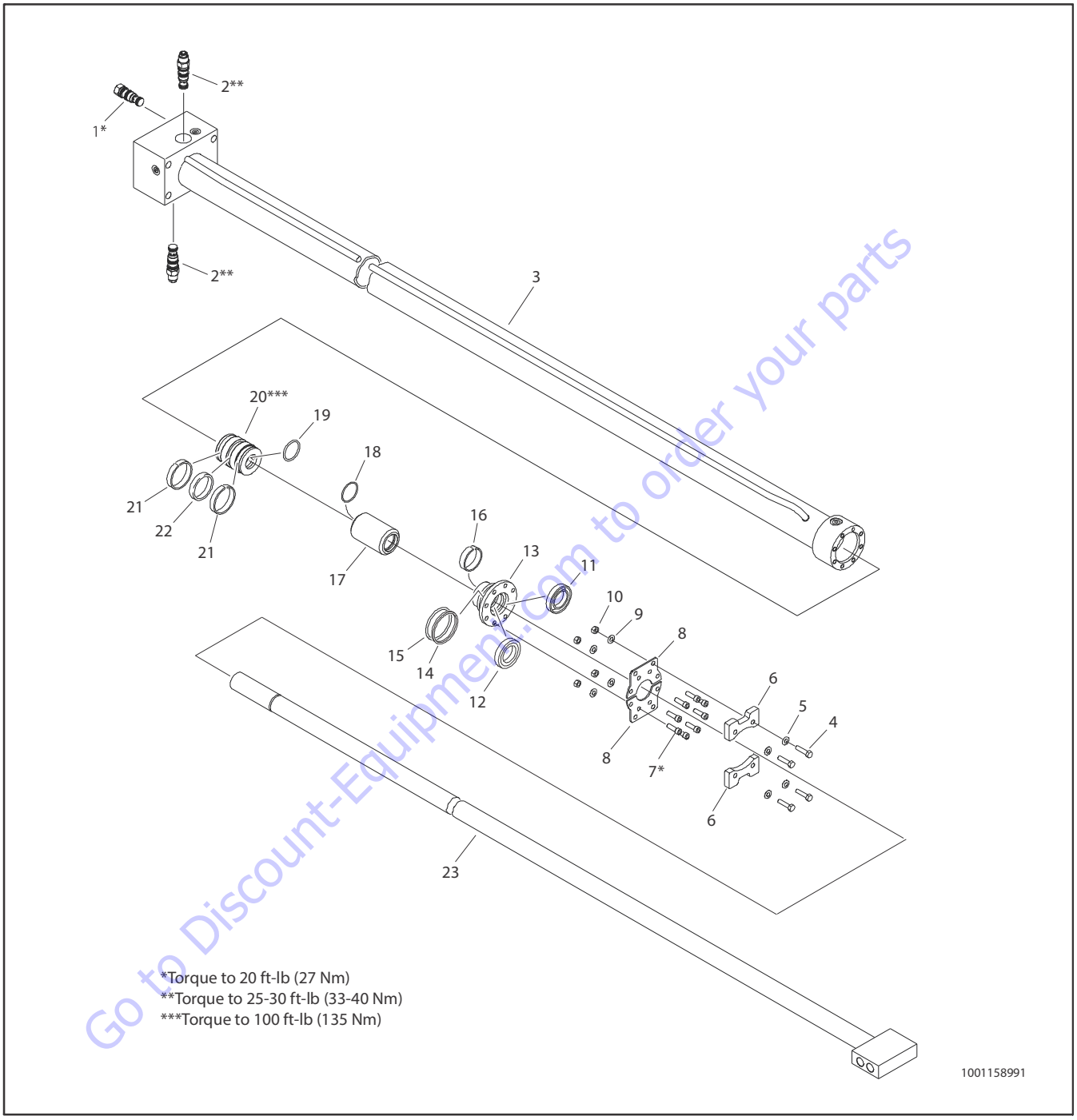


Figure 5-100. Cylinder Rod Support

11. Remove piston assembly (19) from rod (22) with spanner wrench.
12. Remove spacer assembly (16) from rod (22).
13. Remove cylinder head assembly (12) from rod (22).



1. Shuttle Valve	5. Washer	9. Washer	13. Cylinder Head	17. Spacer	21. Wear Ring
2. Counterbalance Valve	6. Wear Pad	10. Nut	14. Backup Ring	18. O-Ring	22. Seal
3. Barrel	7. Capscrew	11. Wiper	15. O-Ring	19. O-Ring	23. Rod
4. Bolt	8. Support Pad	12. Seal	16. Wear Ring	20. Piston	

Figure 5-101. Jib Telescope Cylinder Assembly

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

14. Remove and discard O-ring (19), two wear rings (21), and seal (22) from piston (20).

15. Remove and discard O-ring (18) from spacer (17).

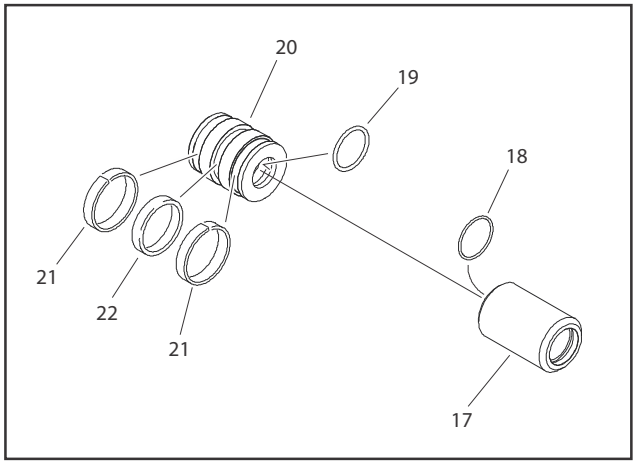


Figure 5-102. Piston and Spacer Disassembly

16. Remove rod from holding fixture and remove cylinder head.

17. Remove and discard wiper (11), seal (12), wear ring (16), O-ring (15), and backup ring (14) from cylinder head (13).

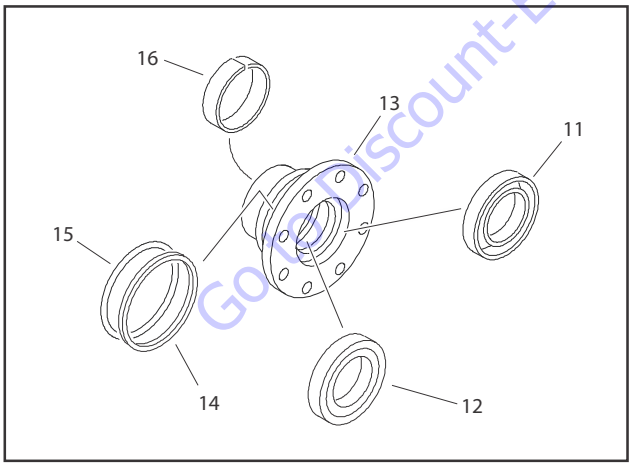


Figure 5-103. Cylinder Head Disassembly

CLEANING AND INSPECTION

NOTICE

CLEAN PARTS THOROUGHLY WITH WATER AND A RUST PREVENTATIVE ONLY. DO NOT USE ANY FORM OF DETERGENT OR SOAP.

1. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.

2. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.

3. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.

4. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.

5. Inspect threaded portion of piston for damage. Dress threads as necessary.

6. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.

7. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.

8. Inspect threaded portion of head for damage. Dress threads as necessary.

9. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.

10. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.

11. Inspect spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.

12. Inspect port block fittings and cartridge valves. Replace as necessary.

13. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION.

1. Install new wear ring (16) in cylinder head (13).
2. Install seal (12) and wiper (11) in cylinder head.
3. Install backup ring (14) and O-ring (15) in outside diameter grooves of cylinder head.

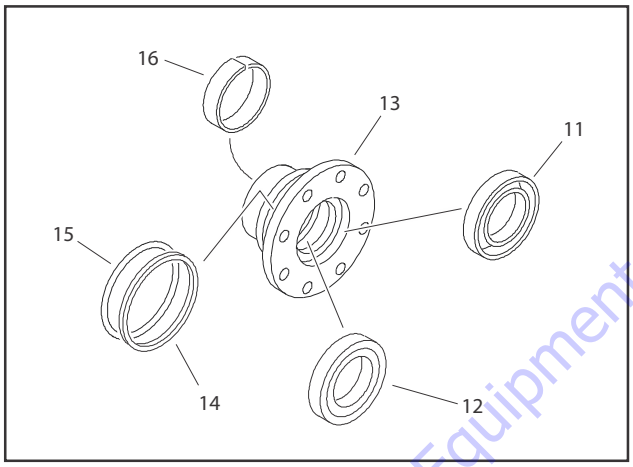


Figure 5-104. Cylinder Head Assembly

4. Install cylinder head assembly on rod. Do not damage or dislodge wiper and rod seals. Push head along rod to rod end.
5. Install O-ring (18) in spacer (17). Slide spacer on rod.
6. Install O-ring (19) to inside groove of piston (20).
7. Install seal (22) and two wear rings in outer grooves of piston.

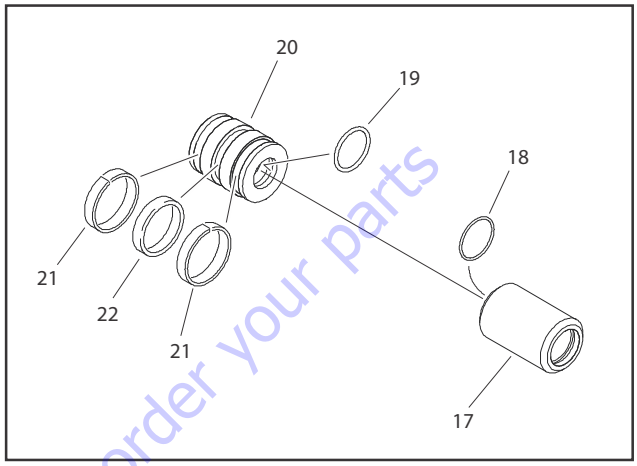


Figure 5-105. Piston and Spacer Assembly

8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Apply medium-strength locking compound or equivalent to rod threads.
10. Install piston on cylinder rod. Do not damage or dislodge O-ring. Torque to 100 ft-lb (135 Nm).
11. Remove cylinder rod from holding fixture.
12. Position cylinder barrel in a suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

13. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston O-rings and seals.
14. Continue pushing rod into barrel until cylinder head gland can be inserted into barrel cylinder.

NOTE: *Apply locking primer and Medium strength threadlocking compound or equivalent to capscrew threads.*

15. Install two pad supports (7) to cylinder head (12) and barrel (2) with eight capscrews (6). Torque capscrews to 20 ft-lb (27 Nm) following sequence shown in Figure 5-107.

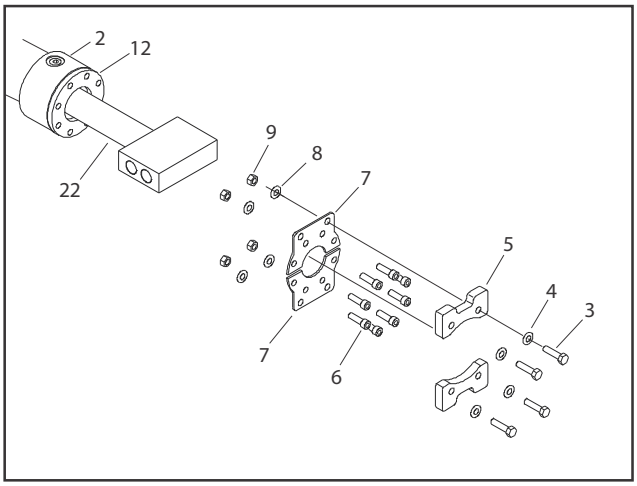


Figure 5-106. Rod Assembly Installation

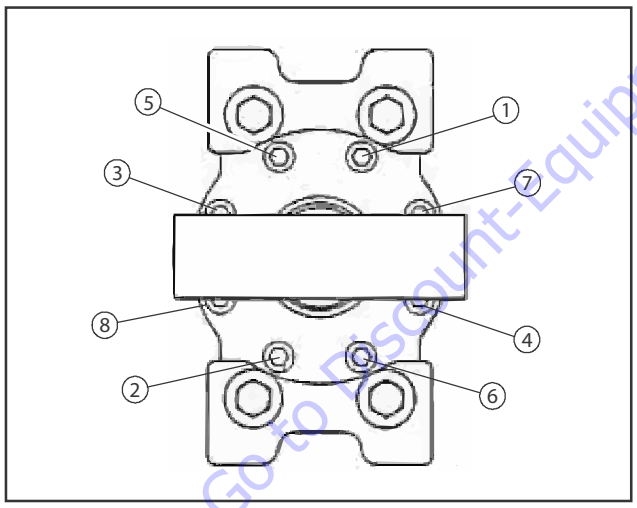


Figure 5-107. Cylinder Head Torque Sequence

16. Install each wear pad (5) with two bolts (3), four washers (4) and two bolts (9).

17. Install shuttle valve (1) with new O-ring in valve block. Torque to 20 ft-lb (27 Nm).

18. Install two counterbalance valves (2) with new O-rings in valve block. Torque to 25-30 ft-lb (33-40 Nm).

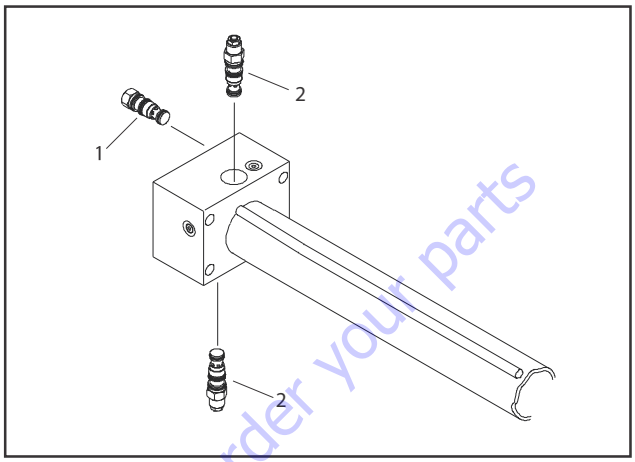


Figure 5-108. Valve Installation

Boom Telescope Cylinder

Refer to Figure 5-112.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate hydraulic power source and extend cylinder. Shut down and disconnect power source. Adequately support cylinder rod.
3. Remove the plugs from the cylinder ports.
4. Place cylinder barrel in a suitable holding fixture.

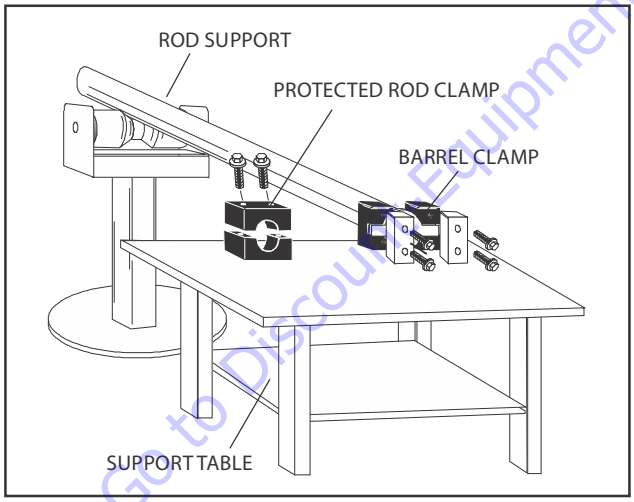


Figure 5-109. Cylinder Barrel Support

5. Remove check valves (3), counterbalance valves (4), and fittings from valve block (2). Discard O-rings. Remove four capscrews (1) and valve block from rod (7). Discard O-rings (5, 6).
6. Mark cylinder head (21) and barrel (25) with center punch marks for later realignment. Remove two capscrews (23) and bracket (24).
7. Remove remaining capscrews (23) and washers (22).
8. Tap around outside of Cylinder Head with a suitable hammer to break thread-locking compound. Unscrew Cylinder Head (23).

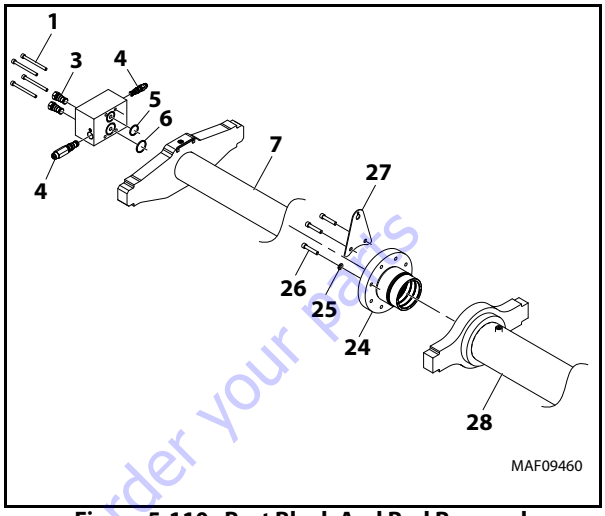


Figure 5-110. Port Block And Rod Removal

NOTICE

PULLING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN REMOVING CYLINDER ROD, HEAD, AND PISTON.

9. Clamp barrel securely. Pull rod assembly and cylinder head from barrel.
10. Protect cylinder rod from damage and clamp in a vise or holding fixture as close to piston as possible.

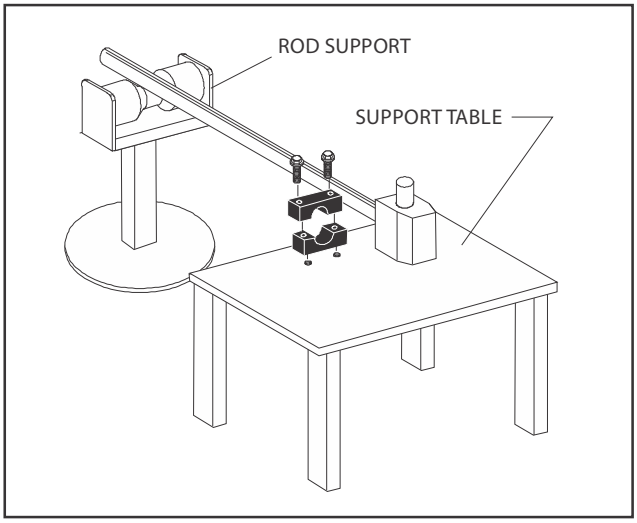
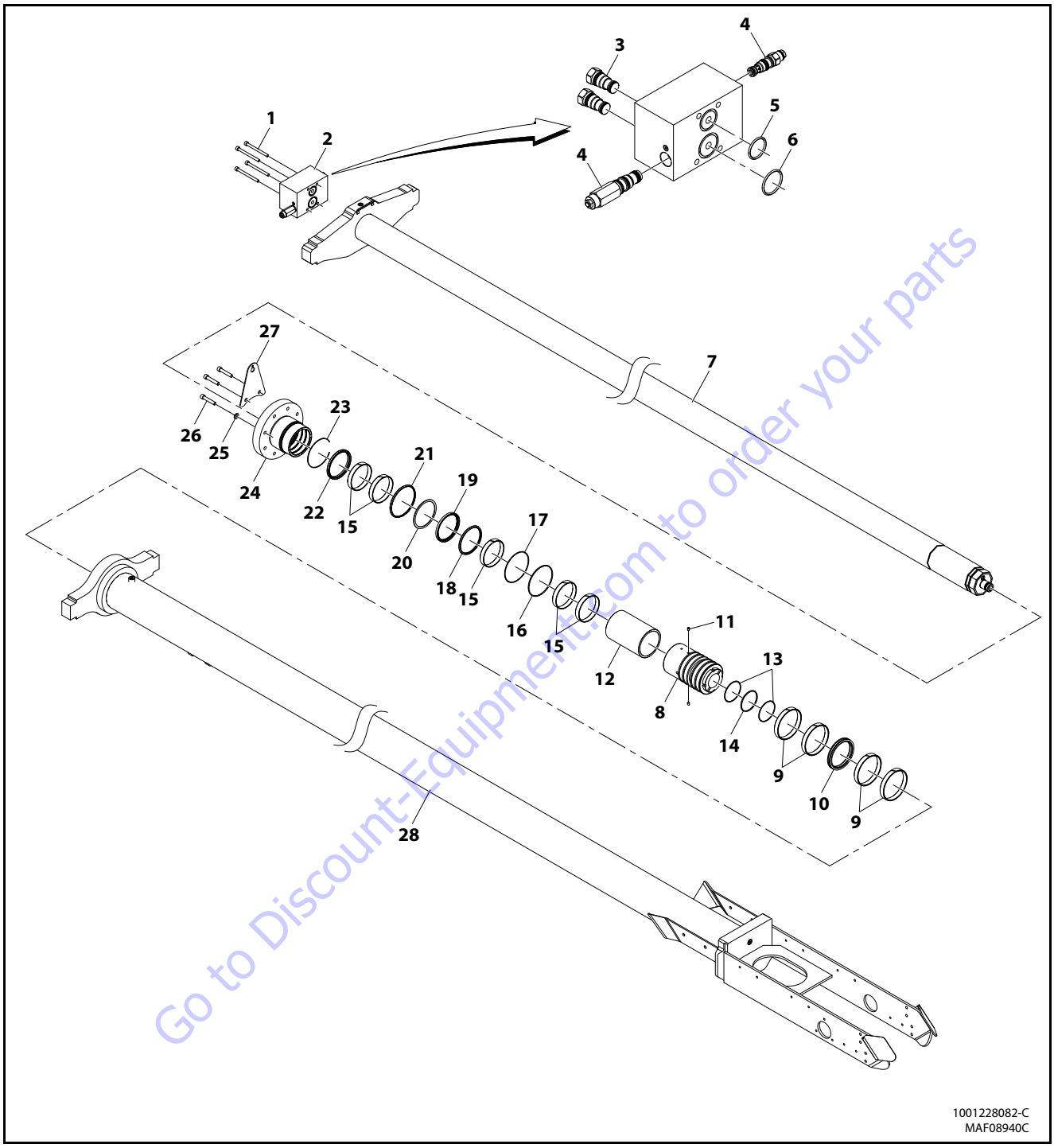


Figure 5-111. Cylinder Rod Support



1. Capscrew
2. Valve Block
3. Check Cartridge
4. Counterbalance Valve
5. O-Ring
6. O-Ring
7. Rod
8. Piston
9. Wear Ring
10. Piston Seal
11. Setscrew
12. Spacer
13. Wear Ring
14. O-Ring
15. O-Ring
16. Rod Seal
17. Backup Ring
18. Head Backup Ring
19. Wiper Seal
20. Retaining Ring
21. Cylinder Head
22. Washer
23. Capscrew
24. Bracket
25. Barrel

Figure 5-112. Boom Telescope Cylinder Assembly

11. Loosen and remove the setscrew which attaches the piston to the rod.
12. Screw the piston counterclockwise and remove the piston from cylinder rod.
13. Remove and discard the piston seal and O-ring.
14. Remove spacer from the rod.
15. Remove the rod from the holding fixture. Remove the cylinder head. Discard the o-rings, backup rings, rod seal, wearing, retaining ring, and wiper seal.

NOTICE

REMOVE SEALS USING A BRASS OR PLASTIC PICK ONLY. DO NOT USE A KNIFE, SHARP OBJECT, OR SCREW DRIVER. MAKE NOTE OF SEAL ORIENTATION BEFORE REMOVING FOR PROPER INSTALLATION.

16. Remove and discard piston seal (10) and piston wear ring (9) from piston (8).

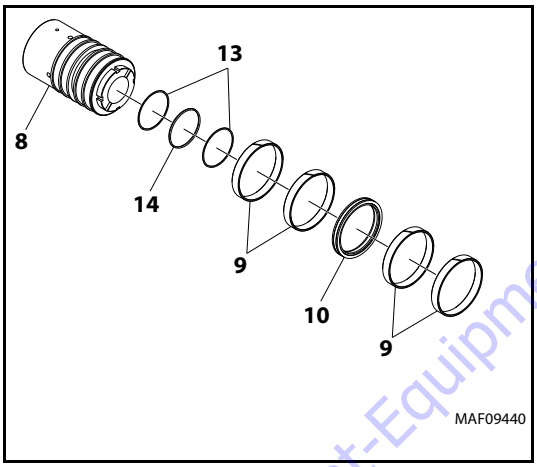


Figure 5-113. Piston Disassembly

17. Remove spacer (12) from rod (7).
18. Remove rod from holding fixture.

NOTE: *Record orientation of rings for reassembly.*

19. Remove cylinder head (21) from rod (7). Remove and discard O-Ring (14 and 15), backup ring (17), head backup ring (18), wiper seal (19), rod seal (16), retaining ring (20), and wear rings (13).

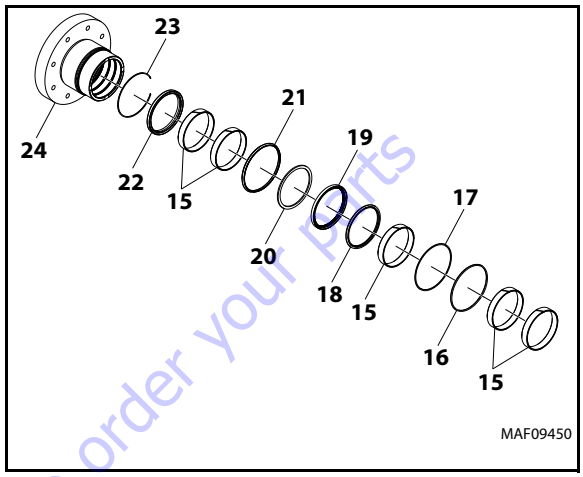


Figure 5-114. Cylinder Head Disassembly

CLEANING AND INSPECTION

1. Clean parts thoroughly with approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
4. Inspect threaded portion of barrel for damage. Dress threads as necessary.
5. Inspect piston surface for damage, scoring, or distortion. Dress piston surface or replace piston as necessary.
6. Inspect threaded portion of piston for damage. Dress threads as necessary.
7. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage, and for ovality and tapering. Replace as necessary.
9. Inspect threaded portion of cylinder head for damage. Dress threads as necessary.
10. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
11. Inspect cylinder head outside diameter for scoring, damage, ovality, and tapering. Replace as necessary.
12. Inspect spacer for burrs and sharp edges. Dress inside diameter surface with Scotch Brite or equivalent.
13. Inspect port block fittings and cartridge valves. Replace as necessary.
14. Inspect oil ports for blockage or presence of dirt or other foreign material. Repair as necessary.

ASSEMBLY

NOTE: *Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.*

Apply a light film of hydraulic oil to all components before assembly.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. WIPER SEAL ROUNDED SURFACE MUST FACE TOWARD PISTON AS NOTED DURING DISASSEMBLY.

1. Install O-Ring (14), backup ring (17), wiper seal (19), rod seal (16), retaining ring (20) in cylinder head (23).
2. Install wear rings (13) in cylinder head (21).
3. Install head backup ring (18) and O-ring (15) on cylinder head (21).

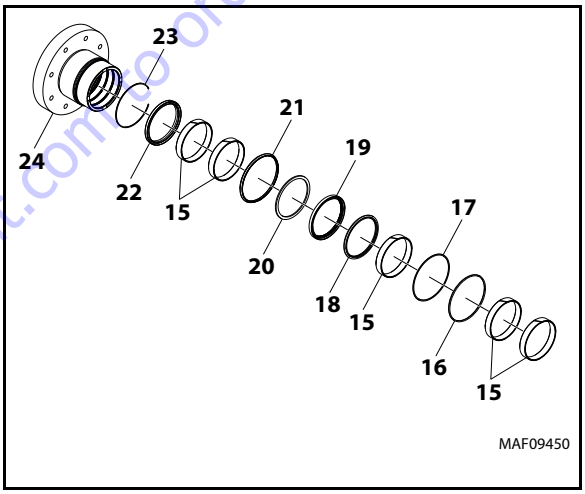


Figure 5-115. Cylinder Head Seal Kit Installation

4. Install cylinder head assembly (21) on rod (7). Do not damage or dislodge wiper and rod seals. Push cylinder head along rod to rod end.

5. Install Spacer (12) on Rod (7) with screw hole facing toward piston end. Align hole in spacer and rod.
6. Install piston seal (10) in piston (8).
7. Install piston wear rings (9) on piston (8).

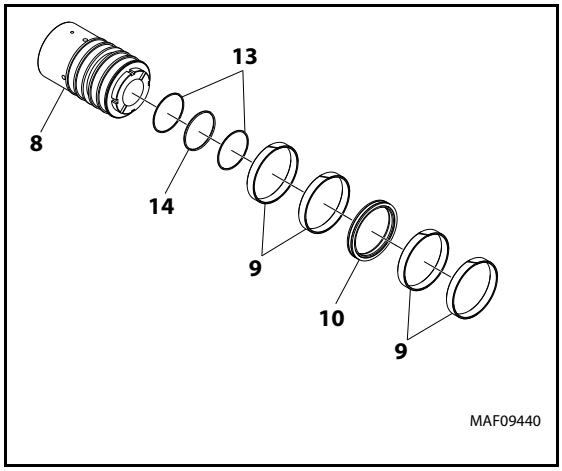


Figure 5-116. Piston Seal Kit Installation

8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Carefully thread piston on cylinder rod hand tight, Ensure O-ring and backup rings are not damaged or dislodged.

NOTE: *Piston and mating end of rod must be free of oil when installing tapered bushing.*

10. Thread piston on rod until it aligns with spacer end.
11. Remove cylinder rod from holding fixture.
12. Position cylinder barrel in a suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

13. Clamp barrel clamped securely and support rod. Insert piston end into barrel. Do not damage or dislodge piston O-ring and seal ring.
14. Push rod in barrel until cylinder head can be inserted.
15. Install cylinder head (21) in barrel (25) and align marks made during disassembly
16. Install bracket (24) with capscrews (23).
17. Install washers (22) and capscrews (23). Tighten all capscrews.
18. Install small O-ring (5) and large O-ring (6) in valve block (2). Install valve block (2) to rod (7) with capscrews (1).
19. Install two check cartridges (3) and two counterbalance valves (4) with new O-rings in valve block (2).

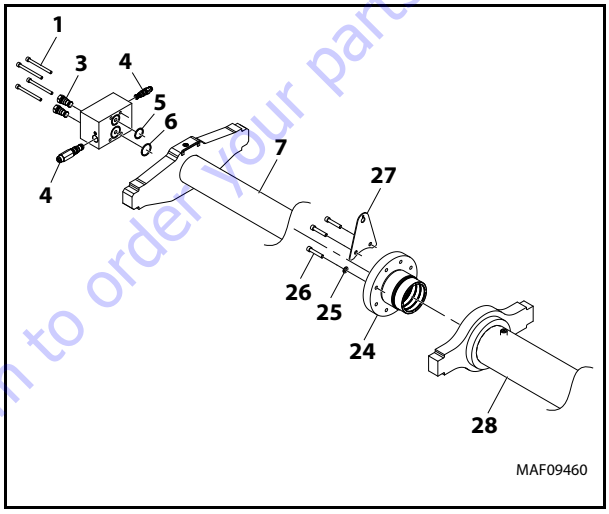


Figure 5-117. Rod Assembly And Valve Installation

5.4 CYLINDER LENGTH SENSOR

Both the jib lift cylinder and the platform level cylinder utilize a cylinder length sensor which communicates with the JLG control system. These sensors can be removed from without the cylinder being disassembled.

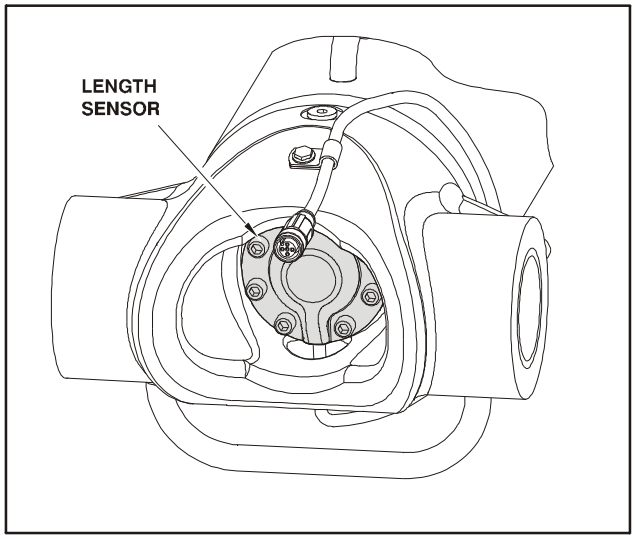


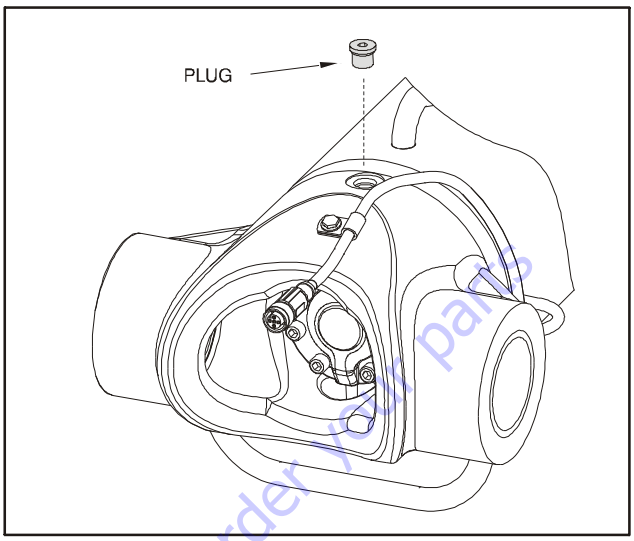
Figure 5-118. Cylinder Length Sensor

Removal

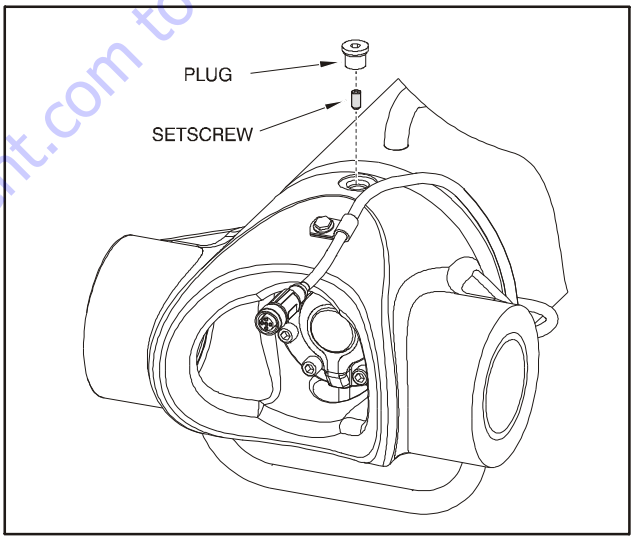
1. Lower the platform to the ground or on suitable blocking.

NOTE: The jib lift cylinder weighs approximately 186 lb (84 kg) and the platform level cylinder weighs approximately 76 lb (34 kg)

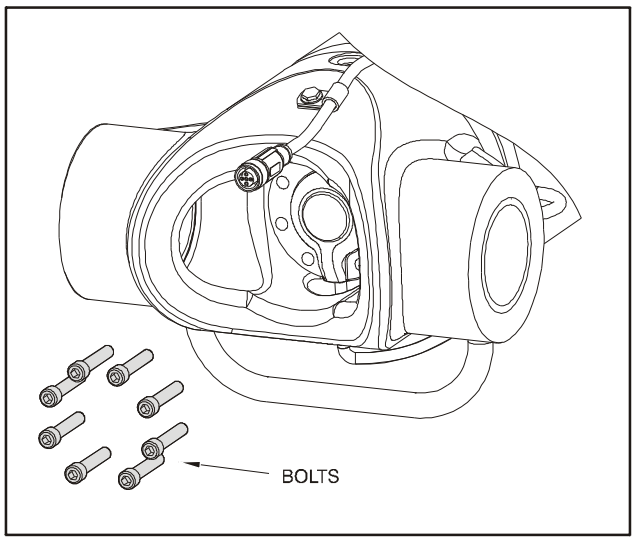
2. Support the weight of the jib cylinder and remove the bolt and keeper pin that secure the cylinder barrel retaining pin. Remove the pin.
3. Lower the cylinder to a horizontal position to gain access to the rear of the cylinder.
4. Place a catch pan under the cylinder to capture any oil that may drain out of the cylinder. If the cylinder is removed from the machine, drain the oil out of the cylinder.
5. Remove the plug that is over the setscrew that secures the sensor in place.

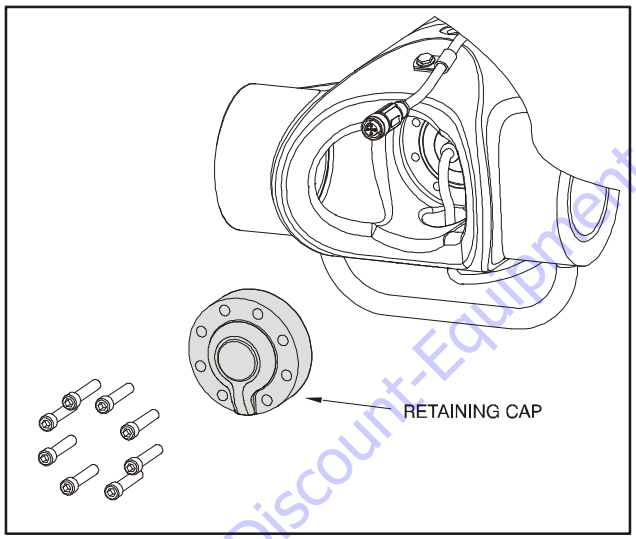


6. Using an allen wrench, remove the setscrew.

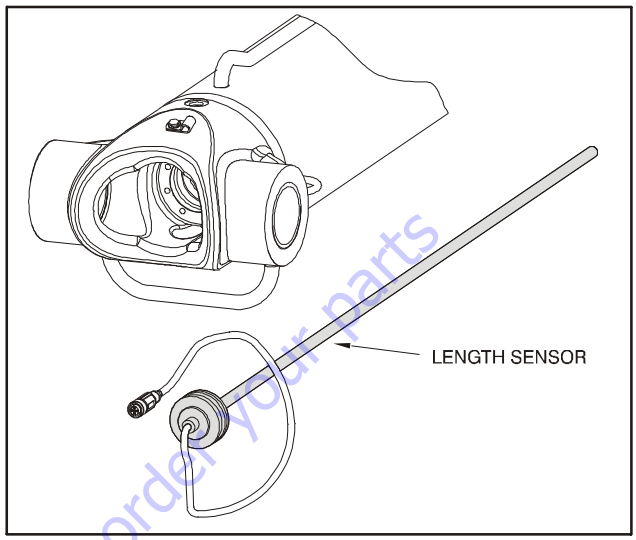


7. Using an allen wrench, remove the bolts securing the retaining cap and remove the cap.



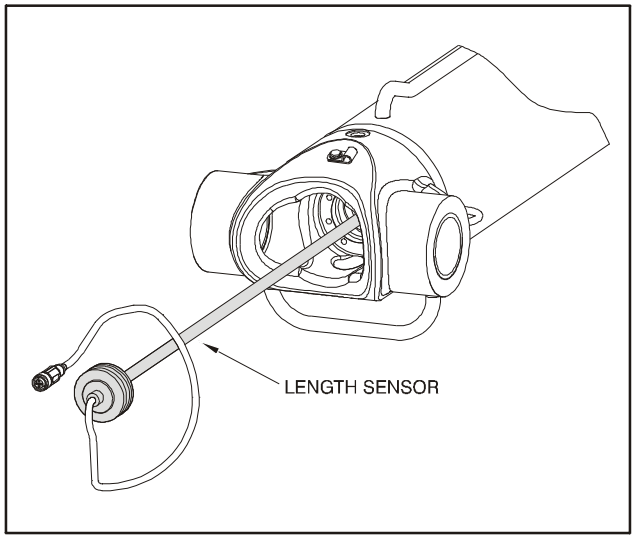


8. Pull sensor out of the cylinder. DO NOT use the wiring harness to pull the sensor out as this will cause damage to the wiring.

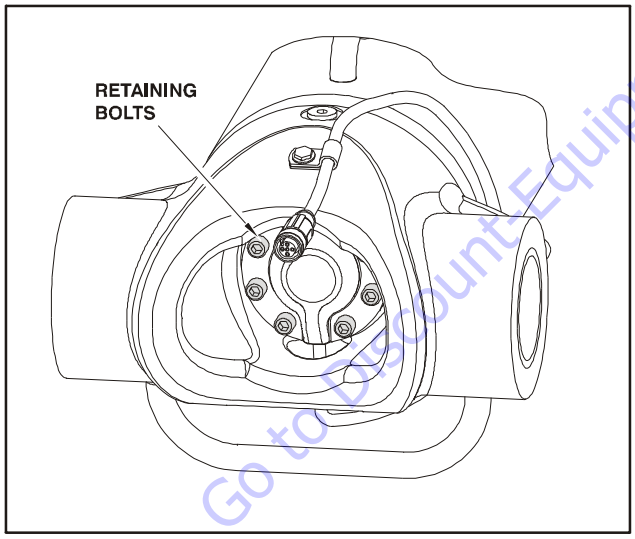


Installation

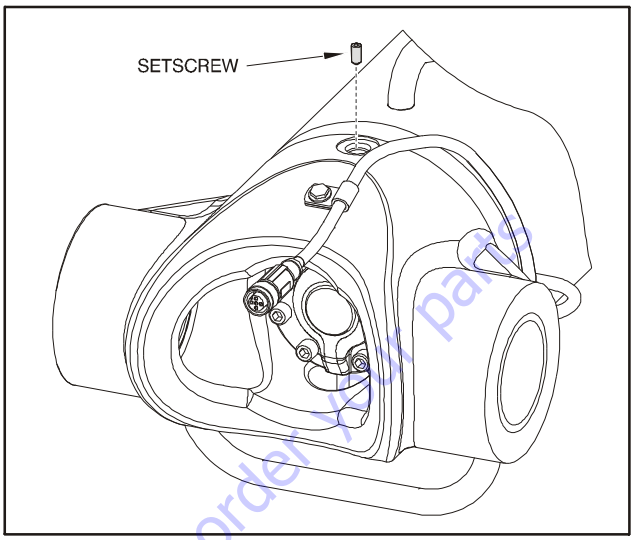
1. Carefully insert the sensor into the cylinder. It may be necessary to gently tap the end of the sensor to seat the o-ring into the sensor bore. DO NOT tap on the wiring harness.



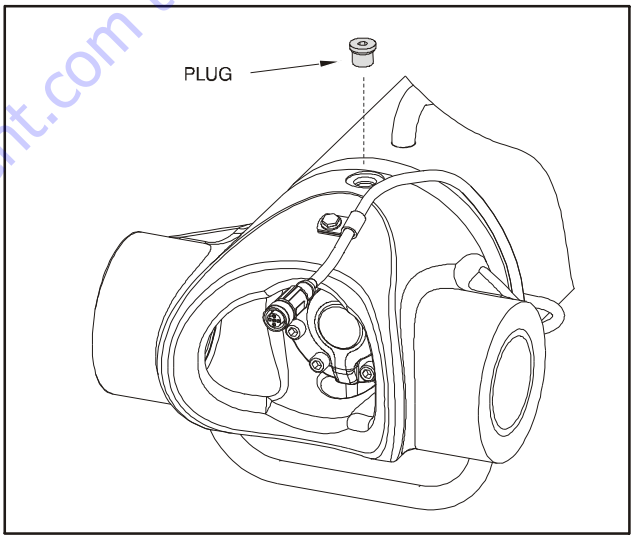
2. Install the cap and secure in place with the retaining bolts.



3. Apply lubricant JLG PN 3020039 to the setscrew and install the setscrew. Torque the setscrew to 4 in. lbs. (0.45 Nm).



4. Install the plug over the setscrew.



5. Raise the cylinder back in place and install the retaining pin.
6. Install the keeper pin and retaining bolt.
7. Check the cylinder for proper operation.

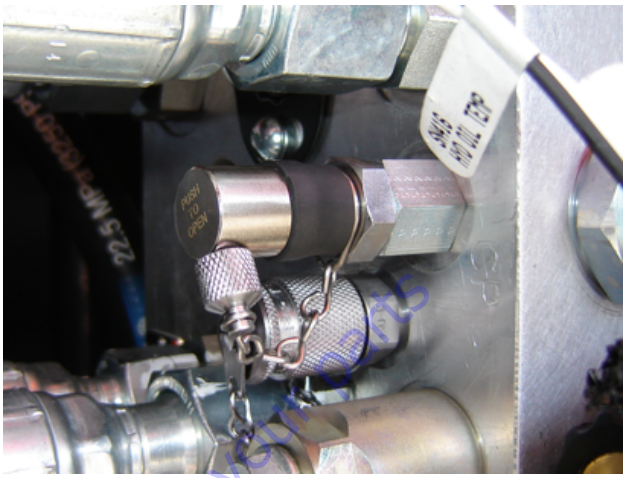
5.5 OIL SAMPLING PROCEDURE

See Figure 5-119., Oil Sampling Valve Location.

This machine is equipped with an oil sampling valve to allow for verification of hydraulic oil condition.

Procedure

1. Function the machine for approximately 15 minutes operating all functions.
2. Switch the select switch to the ground controls and start the engine.
3. Locate the oil sampling valve on the front of the main control valve.
4. Unscrew the knurled end which is attached to the chain.



5. Place a drip pan under the spout and push in for approximately 10 seconds. This should flush out the valve.
6. Open and place the sample bottle under the spout.
7. Push in on the end of the valve and fill up the bottle.
8. Cap the bottle immediately.
9. Thread the knurled cap back onto the valve.
10. The sample is complete.

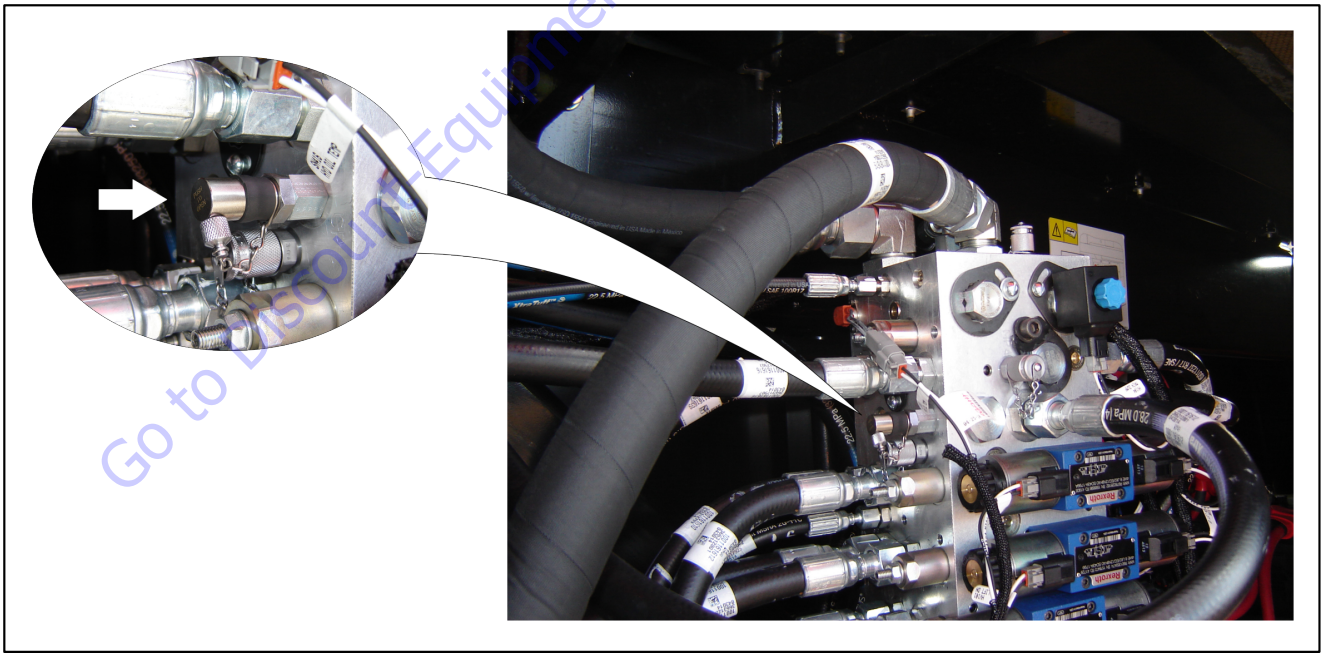


Figure 5-119. Oil Sampling Valve Location

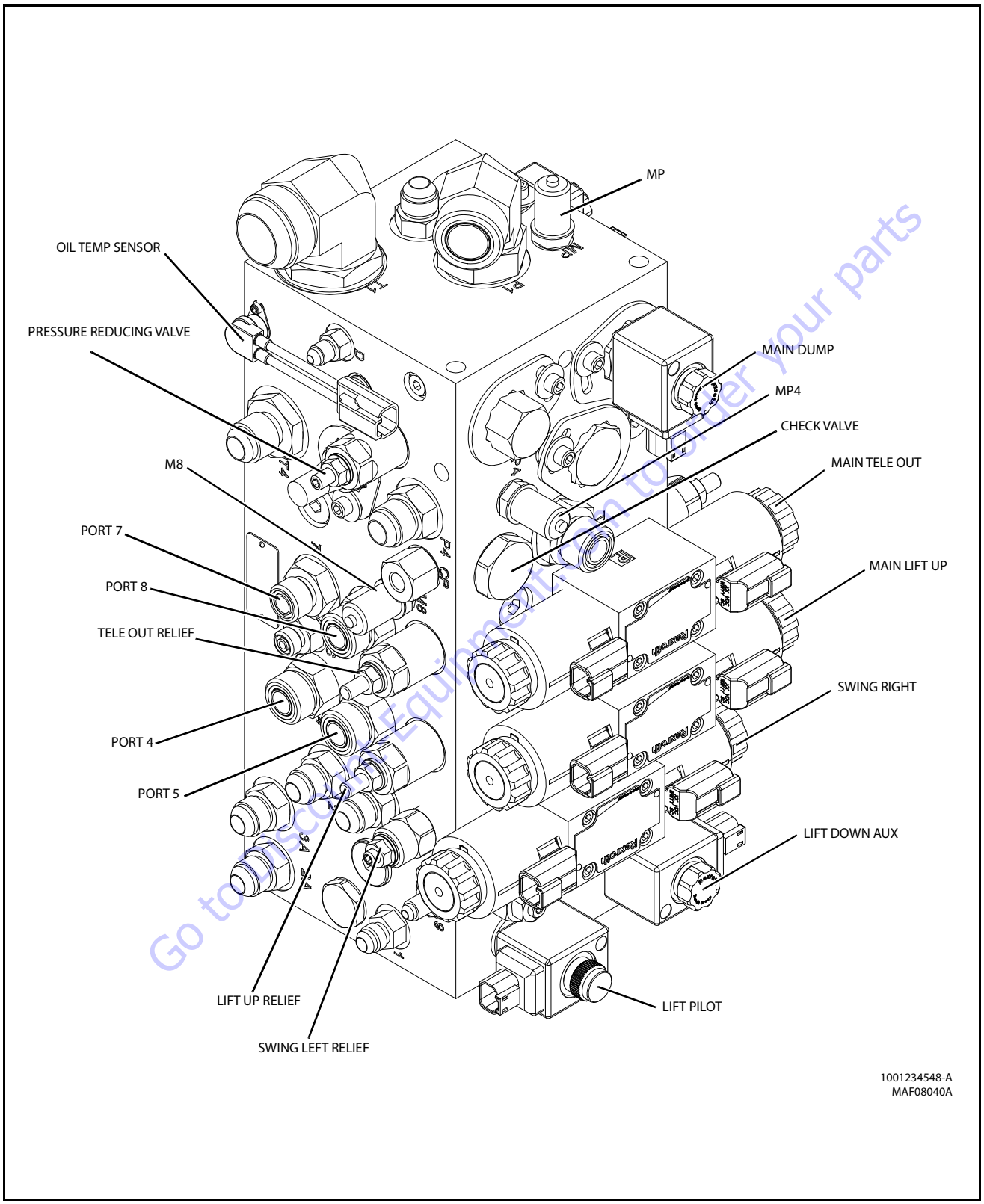


Figure 5-120. Main Valve Identification - Sheet 1 of 2

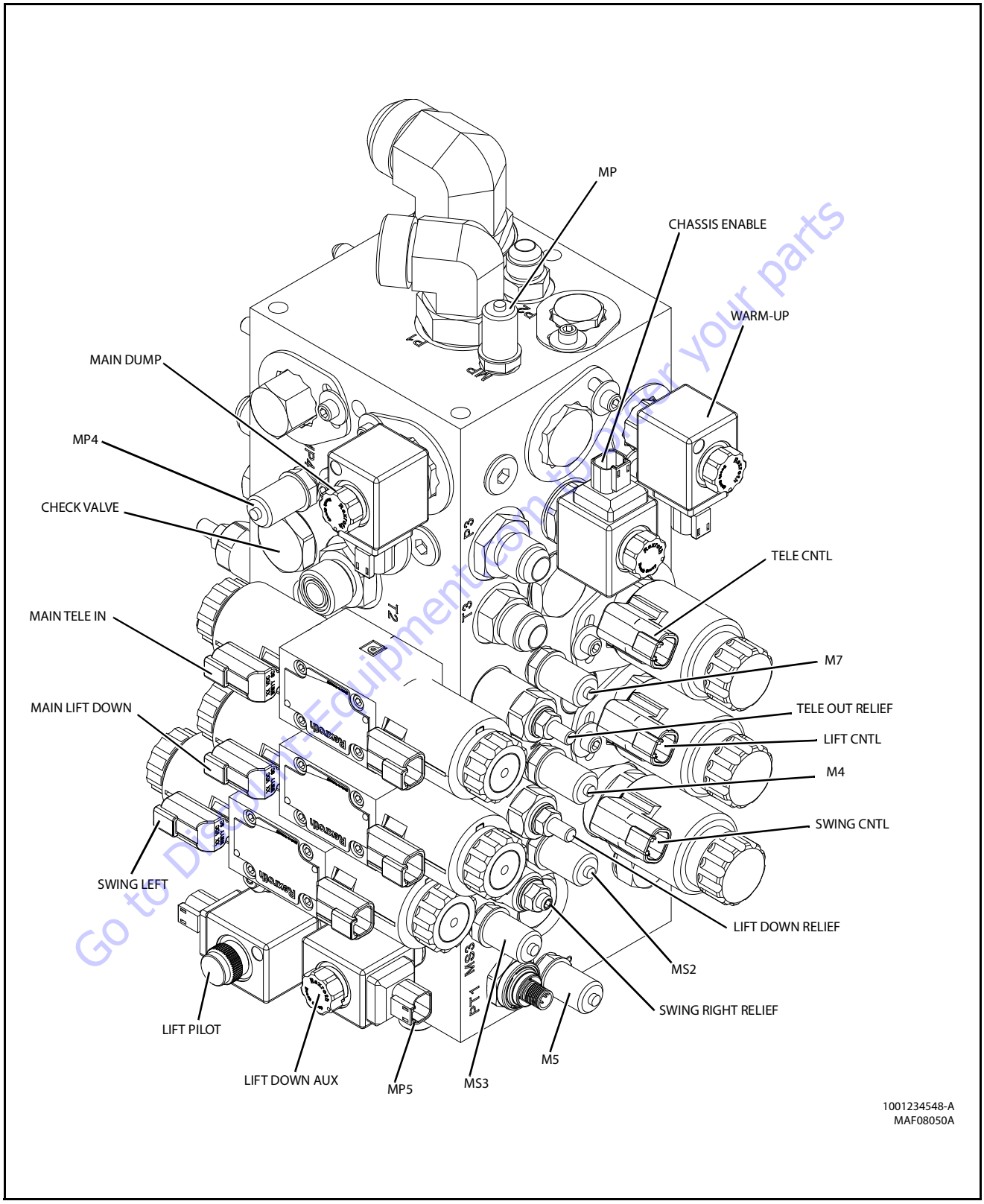
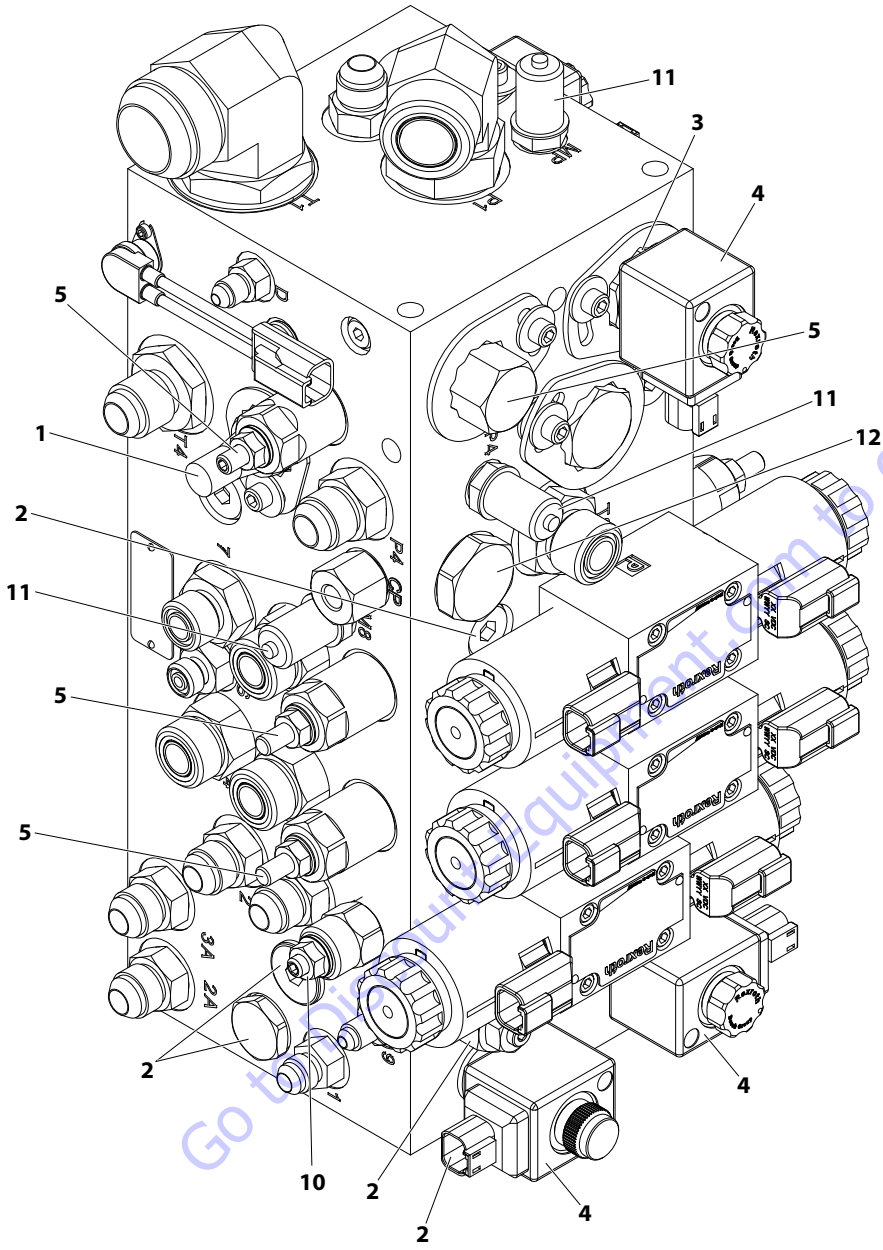


Figure 5-121. Main Valve Identification - Sheet 2 of 2



Item	Ft.Lbs.	Nm
1	60-70	81-95
2	25-30	34-40.5
3	40-49	54-66
4	2.2-3	3-4
5	30-35	40.5-47
6	122-133	165-180
7	3.7-5.2	5-7
8	28.8-37.6	39-51
9	46	62
10	30-37	40.5-50
11	13	17.5
12	33-37	40.5-50

1001234548-A
MAF08060A

Figure 5-122. Main Valve Torque Values - Sheet 1 of 2

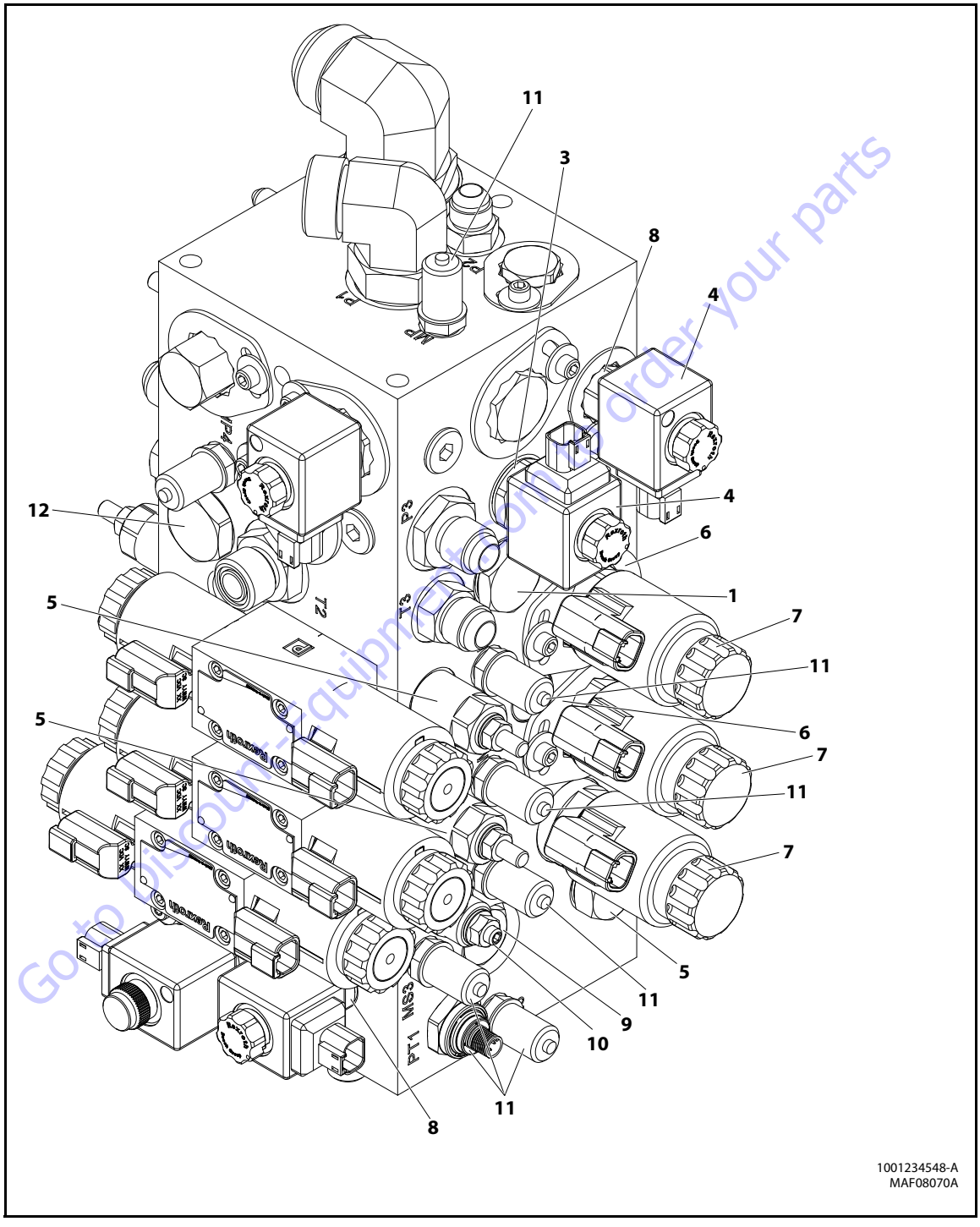


Figure 5-123. Main Valve Torque Values - Sheet 2 of 2

5.6 PRESSURE SETTING PROCEDURE

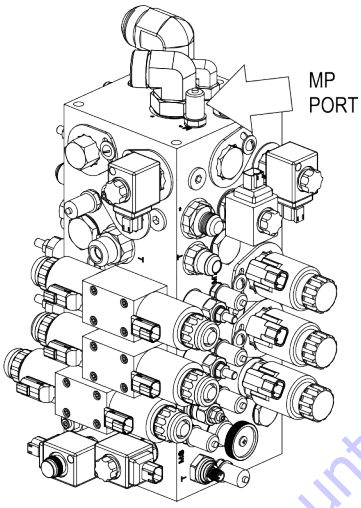
Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends operating the machine until the hydraulic system has warmed to normal operating temperatures prior to checking pressures. JLG Industries Inc. also recommends the use of a calibrated gauge. Pressure readings are acceptable if they are within ± 5% of specified pressures.

To ensure all pressures are set correctly, the following procedures must be followed in order.

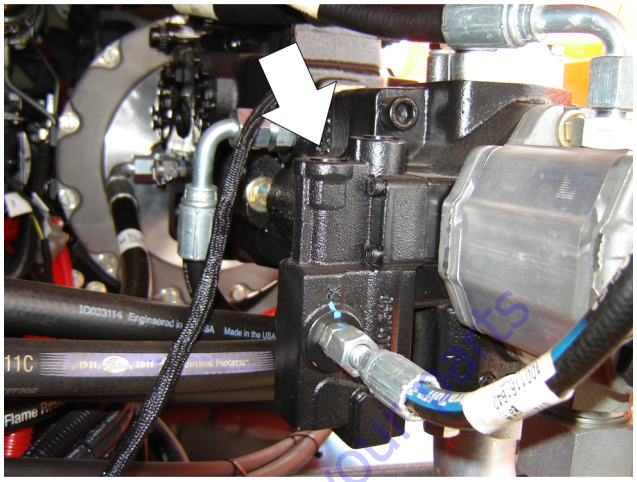
1. Setup of the Function Pump

STAND BY PRESSURE OR LOAD (LS) SENSE PRESSURE

1. Install a low pressure gauge at port "MP" of the main valve block. The gauge must be capable of reading 500 psi (34.5 bar).



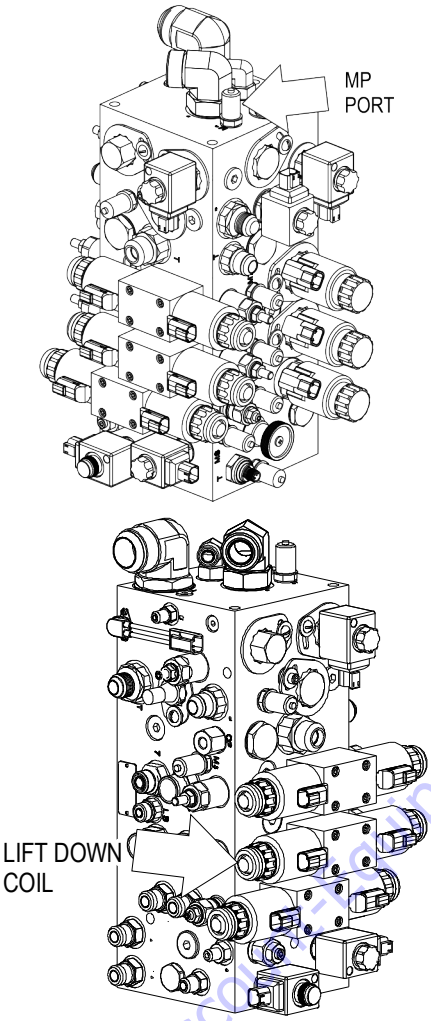
2. Start the engine, the gauge should read 500psi (34.5 bar).
3. To make an adjustment to this pressure, go to the engine compartment, locate the function pump which is the rear pump.
4. The stand by adjustment is the outside adjustment. Loosen the locking set screw at the side of the adjustment. Adjust the LS to obtain 500 psi (34.5 bar), clockwise increases pressure.



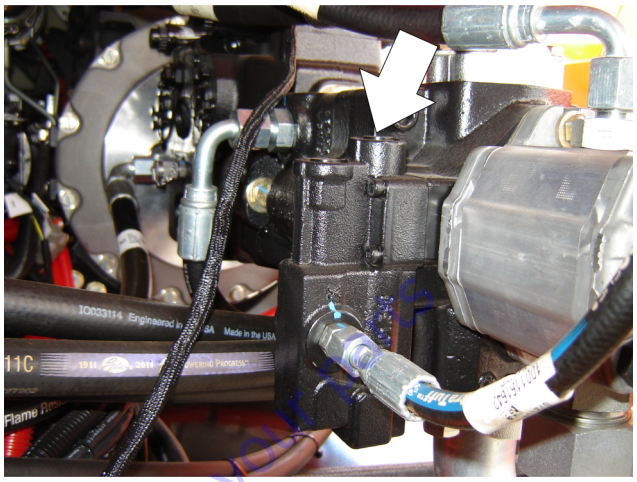
5. After adjusting the pressure, tighten the locking set screw.

PRESSURE COMPENSATOR (PC) SETTING

1. Install a high pressure gauge 5000 psi (345 bar) at the "MP" port of the main valve block.



2. Using the Analyzer, go to service mode - set pressures - passcode:14605, select Boom Lift.
3. Activate boom lift down. The gauge should read 4000 psi. (275 bar).
4. To make an adjustment to this pressure, go back to the engine compartment to the function pump which is the rear pump. The high pressure relief adjustment is the adjustment closest to the pump case.

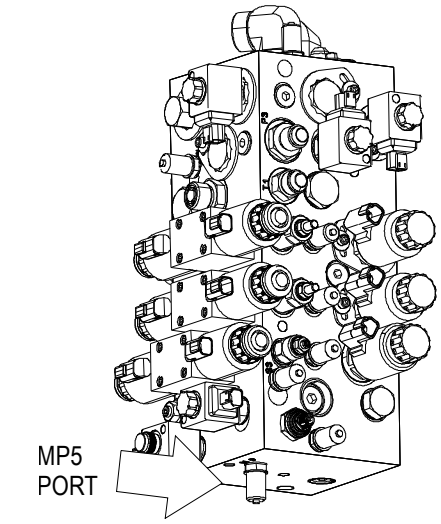


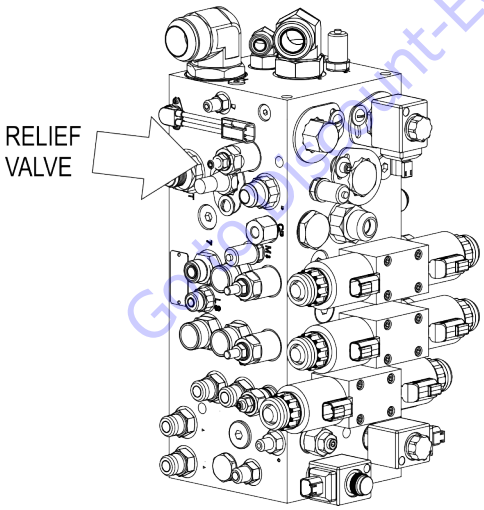
5. Loosen the locking set screw at the side of the adjustment. Adjust the PC to obtain 4000 psi (275 bar), clockwise increases pressure.
6. If a pressure increase is necessary and the adjustment described above does not result in a change, then Perform "Lift Down Procedure" before repeating "Pressure Compensator (PC) Setting".
7. After adjusting the pressure, tighten the locking set screw.

2. Adjustments Made at the Main Valve Bank

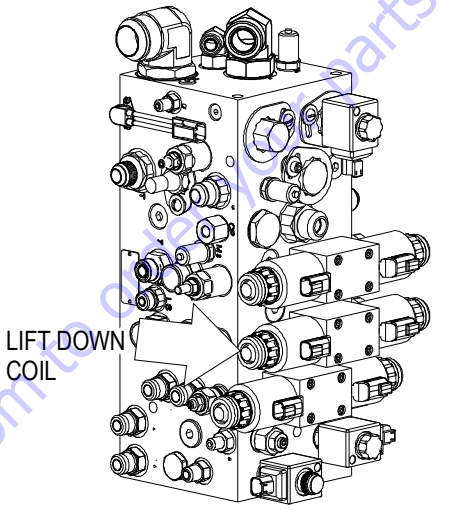
REDUCED PRESSURE SECTION

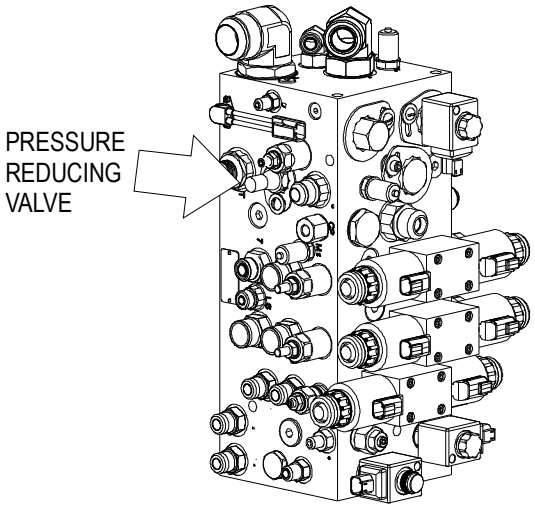
1. Relief Valve: Install pressure 5000 psi (345 bar) gauge at port MP5. Using the Analyzer, go to service mode - Hyd warm up - passcode: 12671. An alternative method is to unplug the temperature and switch on the tank manifold with the engine temperature less than normal operating temperature. Adjust the relief valve located at 5 o' clock adjacent port P4 to obtain gauge reading of 3600 psi (248 bar) After adjusting the pressure, tighten the locking set screw and Exit hydraulic warm up mode.

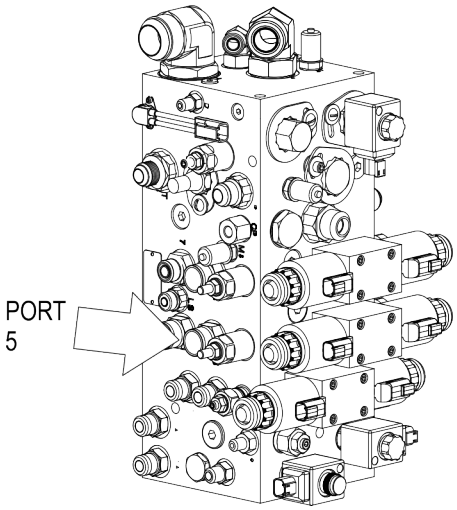




2. Pressures Reducing Valve: Install pressure 5000 psi (345 bar) gauge at port MP5. Using the Analyzer, go to service mode - set pressures - passcode: 14605, select Boom Lift. Activate boom lift down and the gauge should read 3200 psi (221 bar). Adjust the pressure reducing value, located at 3 o' clock behind port P5 until gauge reads 3200 psi (221 bar). If a pressure increase is necessary and the adjustment described above does not result in a change, then Perform “Pressure Compensator (PC) Setting'' and “Relief Valve'' before repeating “Pressure Reducing Valve'' procedure.

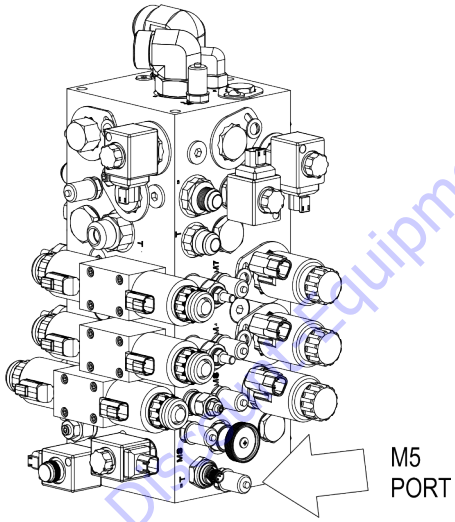




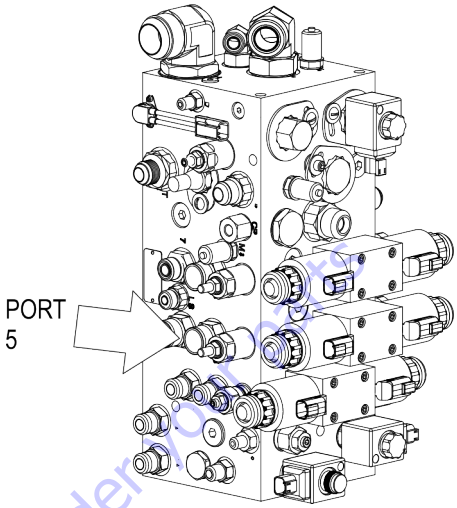


LIFT UP

1. Install a high pressure gauge at the "M5" port of the main valve block.



2. Plug and cap the hose on port 5. Activate lift up. The gauge should read 3700 psi. (255 bar).



3. The adjustment cartridge is located to the right of port 5. Turn clockwise to increase pressure, counterclockwise to decrease.